SCIENTIFIC MATERIALISM AND ULTIMATE CONCEPTIONS

Sidney Billing

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SCIENTIFIC MATERIALISM

AND

ULTIMATE CONCEPTIONS.

"*Ignoramus Ignorabimus.*"—
Du Bois Reymond.

BY

SIDNEY BILLING,
(BARRISTER-AT-LAW)
AUTHOR OF TREATISES ON THE LAW OF PEWS, AWARDS, AND PATENTS.

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PREFACE.

THE pseudo-philosophy, characteristic of the period, has arisen from the broad statement of material views by popular writers on scientific subjects and the generally materialistic tendency of lecture-room teachings. If these teachings are accepted—God (if they admit such) is unthinkable; Life and mind molecular arrangements; Vitality, electrical or physical force; Man, a *sensible* automaton; Creation, but the potence of matter; the casual displacing the actual, the methods of Nature become the Causal fact, and Man's Immortality, final in the expression of Fame. Thus bereft of God, as a Creator and Providence, and of Immortality—*thinking man* in death meets annihilation.

The object of this treatise is to discuss these dicta in plain language; and when words are used which have a scientific as well as a general meaning, the latter is to be taken. The effort has been made to probe the methods of nature as disclosed in her mechanics, chemistry and physics, and to find, as far as may be, the ultimates on which the Kosmos is reared, whereby each reader may arrive at a conclusion, without having wholly to rely upon authoritative dogma. Authority should be accepted *only* when supported by evidences; these evidences, reflected upon and discussed, may then be allowed to stand in the place of an independent idea. Hypotheses are indispensable to research, but they should be examined with a *rigid scepticism*, for "scientific imagination" is only misleading *when scepticism is lulled.*

The method of nature is to be sought in the grand generalizations of Malpighi, Grove, and Darwin. Principles are the bases of the Kosmos—Infinitesimals, its explanation. A knowledge of these infinitesimals constitutes Science: Philosophy has broader distinctions and a deeper aim. Our perceptions of external objects are sense effects exciting consciousness; our conceptions, ideas as units in intelligence impressed on the consciousness; and when impressed, the impulsions by which we Will, Direct, and Control.

Ultimate conceptions, such as God and immortality, find but an indefinite expression in finite thought. If the Kosmos be the endless repetition of a thought there is no death, in the sense of annihilation. Of death the Roman wrote "Mors janua vitæ," Joaquin Miller,

> "This earthly load
> Of death, called life, which us from life doth sever."

When we reflect on the Cause we find a satisfaction in the intelligence which is recognised as everywhere underlying the methods of nature, displaying a purposeness in their conception. Our difficulties arise not so much from the indefiniteness of the conceptions which are formed in the mind, as from the attempts made to render these conceptions, which are necessarily indefinite—definite. If we regard effects as occurring in an invariable sequence, the originating impulsion, however it arises, becomes the Cause; we then have an antecedent existing in its own impulse, disclosing an intelligence and a power sufficient to accomplish every purpose. And as a definition on such a subject is impossible, in the balance of probabilities, we must accept that possibility which is the most probable.

The examination of the various subjects in comment was entered upon *without bias* and with the determination to accept all that was found consistent with reason. The scientific facts are generally accepted—the deductions from these facts alone are denied or canvassed. The conclusions arrived at may be erroneous; the two sides of the questions are presented, and if their examination be as helpful to others as their consideration has been to me, I shall feel repaid for my labours.

My space was limited as my subject was large; to economise I have presented the names of authors without prefix or affix, but in all cases it is intended both should be supposed. To those writers whose matter I have taken, an acknowledgment is made by name or by inverted commas; none named are known to me, so no personality can be assumed. Utterances and writings, *not the men*, have been the subjects of comment.

SIDNEY BILLING.

Sunbury-on-Thames.

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ERRATA.

Names.—Page 3, note 5, for *Gasendi*, read Gassendi. P. 6, n. 3, *Potter*, read Porter. P. 12, lines 8 and 11, *Humbolt*, read Humboldt, and p. 24, n. 2. P. 203, in n., *Euke*, read Encke, twice. P. 237, *Raine*, read Rainy. P. 303, note, line 3, *Dr. Allen Thomson*, read Dr. Allan Thomson. P. 328, n. 1, l. 11, *Tschirhausen*, read Tschirnhausen.

References.—Page 6, fourth note, read 4 instead of 2. P. 11, last note, read 3 instead of 2. P. 187, strike out note 1, it being a repetition of note 2, p. 186. P. 177, line 10, after *Kant*, insert reference to note 1. P. 288, line 16, 1, read 2. P. 317, reference to quotation (*Prop.* Sci.), read (Pop. Sci.).

Misspelt.—Page 4, note 1, for *Spectrescope*, read Spectroscope. P. 18, line 14, *Globegerina*, read Globigerina. P. 46, line 35, *infinitessimally*, read infinitesimally, *et infra*. P. 253, note, line 4, *lancelot*, read lancelet.

Errors.—Page 17, line 18, for *Urea*, read Urine.
,, 41 ,, 27, *in* matter, read from matter.
,, 43 ,, 21, *directing*, read directed.
,, 81 ,, 17, *instructive*, read instinctive.
,, 82, Caption of Chapter—*Hypothesis*, read Hypotheses.
,, 83, note 2, line 3, *saving* respiration, read serving.
,, 84, lines 3 and 4, emphatically *say so*, read say no.
,, 85, note 1, line 4, have *relatives*, read has reference.
,, 87 ,, 2, *in these modes*, read in three modes.
,, 96, line 5, *discovered*, read disclosed.
,, 141 ,, 20, and from the gases, read and from *which* the gases.
,, 153 ,, 24, *that in matter is a postulate*, read that matter is a postulate.
,, 156 ,, 15, *could not be*, read could be.
,, 200, lines 8, 9, 10, *although physical science offers no justification for the notion that molecules can be moved by states of consciousness*, read that states of consciousness are the results of molecular motions.
,, 211, lines 3 and 4, *Unison* harmony, read unison of her harmony.
,, 237, line 12, colour *or*, read colour of.
,, 246, last line, strike out *whether*.
,, 267 ,, ,, *crystalloid*, read crystalline.
,, 278, line 41 (*inertiæ*), read inertia.
,, 281, note 1, line 19, *in the idea* influences, read ideal influences.
,, 287 ,, 2, line 10, through its *merits*, read demerits.
,, 290 ,, 1, line 6, *statement?* read statements?
,, 299, line 34, *phases*, read phrases.
,, 302 ,, 27, *refractions*, read reflex actions.
,, 306 ,, 32, tends to one and &c., read tends to one *mode*, and &c.
,, 311 ,, 13, unchanging; as an, read *and* as.
,, 319, note, line 2, there *is* a, read there was a.

PART I.

SCIENTIFIC MATERIALISM.

CHAP. I.

The Methods of Nature. Animal Electricity and Vital Action. The Hypotheses of the Kosmos. God—Religious Reformers. Strauss. Spontaneity. Protoplasm.

ONLY by a discussion of principles can we arrive at the methods of nature, or rightly estimate phenomena. Every effect should be rigidly criticised, or effects originating in effects may be mistaken for a "precession of causes," and thus by a multiplicity of causes we may be led to accept an indiscriminating materialism, whereby, "matter" enthroned in an indurate eternity, creates herself, and by an inconceivable series of self-constituted motions amazes the consciousness by making intelligence one of its states.[1] Whilst we concede the chemistry and mechanics of nature we admire her resources, but when these creations of the cause are defined to be the infallible cause, the objective and subjective are involved in an indistinguishable chaos. The universal and the unchanging alone are the true, and the true the for-ever subsisting eternal. The universal and unchanging are capable of infinite variation[2] but the principles always remain constant in quality—as *Heat*, *Vitality*, *Consciousness*, and *Intelligence.*

Until it be accepted that principles and their conditions are the working facts of science, speculation[3] will never be banished and dogmatism will retain its ascendency.[4] Ultimate facts are the only bases upon which exactness can be founded; science then instead of being a bundle of specialized threads, presents a united whole; chemistry, mechanics and electro-magnetism, interdependent, are the streams of a vast river whose sources are unknown, whose termination is hidden; the whole interlaced by vital energy. Where in phenomena is found an effect without an antecedent? Vitality, grand though its place be in the Kosmos, has its antecedent in the originating impulse, which precedes and coerces all,—that all in nature which wields the correlated forces as its methods of action whereby particle is interknit with particle, whether the form be animate or inanimate; by which masses are raised and disintegrated, growing from imperceptible realities, and when resolved again into these imperceptions become viewless as the wind. Vitality, the proximate of nature, due to the presence of its simple law, is universal, as *spontaneity* resulting in method. Where shall we seek an atom or a molecule in that absorption, the unity of the universe? The correlated forces result in heat—electricity, heat; magnetism, heat; light, heat; motion, heat; chemical affinity, heat; gravitation, heat; for if it be not a correlated force to what shall its origin be assigned? If in the forces we have a correlation beginning in and resulting in heat, is it not probable the material elements have their origin in the same universality? What is an atom?[1] a sand grain which can be split into imperceptible dust, and as a liquid solution further disintegrated; vaporised, it passes into a beyond inappreciable by the highest powers of the lens; in reason, it would seem to have passed into its primordial. If the primordial be considered an existing entity, imponderable, imperceptible, its conservation is a continuing fact; a matrix ever giving to objectivity and ponderosity, units as representative dynamics—Force and Matter.

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[1] "The purpose of the physical sciences throughout all their provinces is to answer the question *what is?* The purpose of the moral sciences is to answer the question *what ought to be*" ('*Macintosh's Ethical Dissertation*'), or rather what should be our rule of conduct.

[2] The changes in organs are but variations in the great system by which new matter is assimilated to the animal body, and . . . always bear a certain relation to the original type as parts of the same design. ('*Bell, Brid. Treat.*,' p. 24.)

[3] We never attain the certainty "that our conceptions are really identical with truth." Speculative investigation must be admitted yet even "in the so-called exact sciences . . . beyond a certain limit these cease to be exact." (Kekulé).

[4] "Since Bacon's time hypotheses are made and treated as proved, and finally "are gradually raised to articles of faith," and all "who sin against these dogmas are persecuted as heretics . . . " ('*Kekulé*,' Bonn, 1878.)

Chemistry and mechanics, as simulations of the working powers of nature, are the technics of physics, the expressions of a finite intelligence acting by external agencies; the vital fact, the expression of an unlimited intelligence acting through an innate internal convulsion quantitatively and qualitatively assimulating materials and through affinities suiting them to the necessities of varied combinations. The method of nature is shown in its resulting effects—the cause, in its purposed finality. If vital energy were the result of chemistry, mechanics and force whenever the chemist, machinist and electrician concentrated their sciences on their collected materials we have the right to expect in their compacted substance (simulated protoplasm) the exhibition of life. If the vital energy be present in every particle known as substance then in a spontaneity of action the distinction between the inorganic and organic is broken up[1] and we have life in its latent form waiting for apposite conditions to make its display. No composite substance can have qualities not existing in the elements composing it, though in the aggregation new forces become apparent.[2]

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[1] "The chemist will always welcome an explanation of his units because chemistry requires atoms only as a starting point, not as an end." ('*Kekulé*,' Bonn.)

Generally stated, science is perception. When atoms and molecules (not objects of perception) are presented as real and existing quantities, science becomes the imaginative.[3] They may be contemplative necessities in scientific analysis, as symbols to work out the problems presented; but when theories are founded on supposititious quantities inexactness must result.[4] If an atom be distinguished as the smallest severable quantity of an elemental substance, and a molecule[5] as the smallest severable quantity of a composite form, we get nearer to a definition and have Thomson's "definite masses of matter." It is easy to understand that the particles of elemental substances unite in definite proportions, the aeriform, liquid and solid, being different states of the same substances.[6] When phenomena are

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[1] If, as asserted, the architecture of the grain resembles the architecture of the crystal ('*Frag. Sci.*,' 116), it is something like saying that both exist by the same vital fact.

[2] Liebig says, "Vital force manifests itself in two conditions—that of a static equilibrium, as in the seed, and in a dynamic state, as in growth and reproduction."

[3] Democritus taught, "From nothing, nothing can come; nothing that is can be annihilated; all change is only a combination or separation of particles." This is supposed to be the first scientific observation of matter. Bayle's definition was, "The chemical element is that which is not further divisible into materially different parts." With the idea of the chemical element that of indestructibility is connected; from this followed, the invariability of elements.

[4] "The whole value of science consists in the power it confers . . . of applying to one object the knowledge acquired from like objects, ... and it is only so far as we can discover and register resemblances, or differences, that we can turn our observation to account," for "what is true of one thing is true of its equivalent." (Jevons.)

[5] "We are unable to ascribe either the existence of the molecules or any of their properties to the operation of any of the causes we call natural." (Clerk Maxwell.) Herschel, J., said it has "the essential character of *a manufactured article*." Gasendi had a similar idea.

[6] A molecule—"the smallest particles of a substance in which its qualities inhere, or the smallest particles of a substance which can exist by themselves." "Among chemical reactions we may distinguish three classes—1st. Those in which molecules are broken up into atoms. 2nd. Those in which atoms are united to form molecules. 3rd. Those in which the atoms of one molecule change places with those of another, *i.e.* analysis, synthesis, metathesis." ('*Cooke's New Chemistry.*')

Kekulé says, all the conceptions which the mind could form regarding the *essence of matter*, the hypothesis of *discrete* mass particles has led to an intelligible explanation of facts. "We must imagine matter consists of small particles uniform analysed only forms and forces are found, their infinite modifications objectively presented—Nature. By force elemental substances are disintegrated, but it is impossible to say nature recognises atoms, the composites arising through affinities resulting from an innate action. When Malpighi said all things were composed of littles, he spoke of the increase of substances through the centralising focus or nucleus and by deposition. It is probable the germ is as much insisting in simple elemental substances as in composite organic forms, for a mass has no other qualities than those of its elements; germs have multiplication through an active vitality, whilst the particles in elemental substances cohere through a latent vitality; in the processes of crystallization there is a something approaching interbreeding or multiplication, although the formation is said to be mechanical, because it is a deposition by layers.

In all organic combinations carbon is present. In any of its forms it cannot be fused. In its perfect form (the diamond) when combusted, there are no *débris*. In the gaseous form it is known only in combination, and in some phase or other it appears in all substances; a review of all the facts relating to it gives the idea of an objective form of heat.[1] Heat is a universal

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in their material and not further divisible, not even by chemical processes.' Of *atoms* they accumulate "in consequence of forces inherent in them or acting on them, and thus produce systems of atoms or *molecules*." "If this conception of the essence of matter is taken, chemistry may be defined *as the science of atoms*, and physics as the *science, of molecules*," and "that which treats of *masses* as a separate discipline in mechanics. Mechanics, physics, and chemistry . . . are the bases of all special natural sciences because . . . all changes in the great Kosmos or in the microcosmos of the vegetable or animal body can be but of a mechanical, physical, or chemical nature." Atoms he calls "the building stones" of which the molecules are constructed. "*The separate atoms of a molecule are not connected all with all or all with one, but, on the contrary, each one is connected with only one or with a few neighbouring atoms, just as in a chain, link is connected with link.*" "Atoms within the molecule *must be* in constant motion, although nothing certain is known respecting the nature of this motion." "The motion of atoms, therefore is certainly similar to that of molecules in the solid state, and thus it may be said that the *molelcules of existing substances* are *solid aggregations of atoms*." The nature of the motion of atoms, unknown at present, perhaps may be imagined as an oscillatory one in such a way *that the number of oscillations executed in the unit of time* exactly represents the chemical value. Chemical quantivalence only accounts "for the *chemical serial connection*," but does not explain "their *position in space* and the *form of molecules*." Investigations show "that the nature of the connection of atoms influences the *mean distances of atoms*." The nature of the forces which connect atoms has "not been made up at present.' The electro-chemical theory of Berzelius proving insufficient. "Besides the chemical quantivalences the *specific intensity* must also be considered: whether the property of atoms is dependent on *weight* has not been obtained," "but this seems certain, *that the numerical value of the atomic weight is the variable by which the substantial nature and all properties dependent on this are determined*." ('*Rectoral Address, Bonn*,' 1878.)

[1] Higgins considers the spectrum of a comet may be regarded as that of carbon. Secchi and Wolf came to the same conclusions. ('*Proctor, Spectrescope*, p. 98.)

principle, and the more its active state can be nullified the nearer the solid is approached, as shown in condensing into a liquid form oxygen, nitrogen, hydrogen, and air. A great stress is laid on the mechanical action of heat, but its application should be to the antecedent working fact.[1] Motion is the result of heat, its condition (heat) being expressed as vibration; as a principle heat is the parent of its conditions, heat, light, electricity, &c., known as the correlation of forces.[2] To the expression of heat as an antecedent principle acting through its conditions we owe all we know of phenomena. Heat, instead of being "a mode of motion" is the principle to which motion is due. Motion is an effect; an effect may be the mode of the manifestation of a principle, but a principle cannot be the mode of an effect.[3]

What vitality is we do not know, but can say were there no heat there were no exhibition of life; if, as said, life be only animate motion, life becomes a modification of heat. Temperature merely expresses the dynamic state of heat. Heat and life may both exist without the expression of form; form then becomes the objective expression of an activity through the operations of law, thereby presupposing an intellectual predisposition.[1] If all acts be the embodied facts of an intelligence subjective to itself, resulting in an objective form, then all analysis becomes in intelligence a synthesis. Perception is embodied in conception, and conception in result is perceptively embodied; the image symbolised in the mind is as subjective a reality as phenomenon in its objective phase is real to the senses.[2] Finite powers give but an imperfect presentment of objective forms, but when the finite is magnified into infinitude the analytical becomes the synthetical; then intelligence embodied in principles works out in analysis, by a multiple of littles, all objective phenomena. If this subjective intelligence be existing, we have the creative idea embodied in substance. It appears idle to say from the objective or material is produced the intellectual and subjective or ethereal.[3] It does not follow because we find the incomplete presentment of a form which, by progressive steps, becomes complete (the horse), that the first presentment was merely tentative; in the completed form is seen the completion of the conceptive idea; are we then to say that so vast a stretch of intellectual power is a resulting effect, a potence of matter?[4] The facts of natural phenomena, as we trace them, show that the perfected organism is reached by a sequence of almost imperceptible differentiations in form and function. The finite commences in littles, and developes into magnitudes. Watt devised his engine, but did not conceive the magnitude of the perfected machine, and its almost infinite adaptation to mechanical force. The infinite begins in conception, and presents the first form as the commencing step of the design, the perfected image being present in idea before its first presentment became phenomenal; in art the design is conceived before the idea is manipulated.

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[1] Seguin, in a work on railways, 1839, expressed an opinion, entertained in common with himself, by his uncle Montgolfier, of the identity of heat with mechanical force, and calculated its equivalence. The idea has been practically illustrated independently by Joule and Helmholtz. (*Vide infrà*, article "*Heat.*")

[2] Mr. Justice Grove, in his work on the '*Correlation of Physical Forces*' (p. 153, 4th ed.), says, "A prepared daguerreotype plate is enclosed in a box filled with water having a glass front with a shutter over it. Between this glass and the plate is a gridiron of silver wire; the plate is connected with one extremity of a galvanometer coil, and the gridiron of wire with one extremity of a Breguet's helix—an elegant instrument, formed by a coil of two metals, the unequal expansion of which indicates slight changes in temperature—the other extremity of the galvanometer and helix are connected by a wire and the needles brought to zero. As soon as a beam either of daylight or the oxyhydrogen light is, by raising the shutter, permitted to impinge upon the plate, the needles are deflected. Thus light being the initiating force we get chemical action on the plate, electricity circulating through the wires, magnetism in the coil, heat in the helix and motion in the needles."

[3] Science calls heat vibration; yet the heat of the sun is commented on as specific. If heat be the mere vibration of material particles, there can be no exhaustion of the sun's heat. The heat, or whatever the principle, the sun has the power to produce its like, and thus the planetary system depends on his energy. No science shows that the capacity for the excitation of the vibrations can be nullified. The text-books continually speak of the store of heat in the sun, &c. If the vibratory theory be true, then the sun imparts to the earth the potence of excitation even when not directly acting on a particular surface, as in the night. Are we to suppose the potence is always becoming active? or that in consonance with the theory that the vibratory action once set up is always in action, intensified only when reflecting the direct heat of the sun? In light heat is spoken of as a something specific, as the calorific rays. Light will pass through a lens of ice without melting it and fire a match beyond. If heat be but a vibration of the particles of the mass, how is the cohesion of the particles maintained, and how can the mere motion of the particle fire the match beyond? If, on the other hand, it be said heat is the vibration of the elements of the ether, then, as it directly passes through the lens, whether of ice or of glass, it leads to the inference that it is a something specific, a substance imponderable only because science has no balance sufficiently delicate to detect its weight. (*Vide infrà*, Part 2, "*Heat.*")

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[1] The great Creator of all things has infinitely diversified the works of his hands but at the same time stamped a certain similitude on the features of nature that demonstrates to us that *the whole is one family of one parent*." ('*Zoonomia*,' E. Darwin, pref., 3rd ed.)

[2] It is but to exercise our reflections to find we are in the centre of a system wherein the strictest relations are established between our intellectual capacities and a material world. (Bell, '*Bridg. T.*')

[3] The mind is forced to interpret the impressions received through the senses as proofs of the reality of a material world, and in like manner is forced to interpret the intuitions of dependence and moral obligation as proofs of the reality of a spiritual world." (Potter, '*Sci. and Revel.*,' p. 33.)

[4] If the "structure of the universe is 'an insoluble mystery' ('*Belfast Ad.*'), what evidence is it possible to adduce for the "potence of matter?" The riddle only becomes more perplexed. "I have asked myself can it be possible that man's knowledge is the greatest knowledge—that man's life is the highest life?" (Tyndall,

It is said that the universe[1] is a mere mechanical arrangement; Helmholtz says there is no machine but is the result of intelligence. To this intelligence we direct our enquiry and find an infinite expansion of thought beyond the power of the finite to penetrate. When we are told that the germ[2] contains all the successions of phenomena, we must conceive the intelligence which devised this *germ machine* and endowed it with powers which consummated the purposes of its institution. To speak of the universe as a machine is to speak also of the intelligence which designed,[3] fashioned, and not only crushed its energies into form and fact, but instituted them. If the universe as a consummated problem be unfathomable, how much more does it become so when we ponder on the little, the first condensed speck which, by the expansion of its law becomes all we know and see, or imagine we know and see. When human ingenuity has penetrated the outlying facts of the material phenomena, it has its pause, for the mystery of life, the mystery of mind and the greater mystery beyond, hitherto have defied all human scrutiny. The Finite is a grouping without, the Infinite an expansion from the centre comprising all within its concentrating power. Physical force is a resulting agency, vital force is the fact of the cohesion and coherence of the universe. Vital function thus becomes the inherent power which moulds masses, crystallizes the inorganic, and granulates the organic, the impulsive power of living forms.

Huxley says "Our thoughts may be delusive, but they cannot be fictitious." "Thus thought is existence," for all our conceptions of existence are concentrated in thought.[4] Objects are but symbols of things painted on the retina of the eye and

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Manchester.) Have we not his answer when he discerns "in matter" all the forms and *qualities* of life?" ('*Bel. Add.*')

[1] Erasmus Darwin, in his preface '*Zoonomia*,' says persons "idly ingenious busied themselves in attempting to explain the laws of life by those of mechanism and chemistry; they considered the body as an hydraulic machine, and the fluids as passing through a series of chemical changes, forgetting that animation was its essential characteristic."

[2] "Who could have believed that the germs of all the fair objects which we behold in nature were in that void and dark and formless earth over whose waters the Spirit of God spread his fostering wing?" ('*Thoughts on Person. Rel.*,' Goulburn, p. 10.)

[3] "We cannot think at all about the impressions which the external world produces upon us without thinking of them as caused; and we cannot carry out an enquiry concerning their causation without inevitably committing ourselves to the hypothesis of a first cause." (Spencer, '*First Principles*,' p. 37.)

[4] "The complexity of structure belongs to external nature." "We do not perceive a relation between this complexity and the mind . . . the mind may be as distinct from the bodily organs as are the exterior influences which give them exercise." (Bell, '*B. T.*,' p. 7.)

translated in consciousness. In cases of colour blindness red appears to be green; this would show that it is collective rather than individual experiences which determine a fact, and yet the green colour is as vivid a reality to the individual, as the red by collective experience, is determinative of the conception. As the external sense of vision is deceptive so may conclusions be which are ingrafted on perception. Physical science built upon perceptive experiences can be truly translated only as they are reliable. Intellectual phenomena are only known as effects connected with objects. Material philosophy therefore pronounces all to be the resultants of matter and molecular changes. Had we not intellectual consciousness there would be neither perception nor conception, objects, nor thoughts. When the symbol photographed in the eye receives translation it becomes our reality.[1] How then can it be said the major (mind) has its origin in the minor? (matter); logically we know all majors are composed of minors, but this can be said only of related things; pile as we may atom on atom we should never elicit mind, pile idea on idea and a wisdom would be attainable approaching the precincts of infinitude. Perceptive knowledge is built up of the symbols of things, *not of things.* How then can we say that the symbolical expression of that we term matter, objective forms, creates the subjecting intellect? Water swells upon the application of heat, the mass being affected by an action within the particles,[2] the manifestation is influenced from without. How then can we say the closely compacted brain moves through it own motion?

Admitting molecular changes, they occur through an external impulsion. Water at an unchanging temperature uninfluenced by external forces would remain apparently a motionless mass; and so the brain, unless influenced by a something external to itself, would exhibit the same death in life; only on an irrefragable evidence can it be accepted that consciousness and intellect are the result of changes in the positions of its material particles—this evidence is wanting. Were it otherwise, we must say matter comprehends itself—"inert matter" thinks. When the confession is made that "our knowledge of anything we know and feel more or less . . . is a knowledge of states of consciousness" (however we may dissent from the statement as to *states* of consciousness), it is difficult to understand that these "states of consciousness" can originate from matter. The symbol of a thing is expressed in consciousness, and but for the intellect it would there stagnate like water uninfluenced by forces. To make the proposition more obscure, we are told that

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[1] "In the nervous system it holds universally that variety or contrast is necessary to sensation." "The brain is insensible—that part of the brain which, if disturbed or diseased, takes away consciousness, is as insensible as the leather of our shoe"! "Reason on it as we may, the fact is so—the brain, through which every impression must be conveyed before it is perceived, is itself insensible." (Bell, '*Bridg. Treat.*,' pp. 161, 162.)

[2] Prout says, "heat envelopes each molecule in the form of an atmosphere." ('*Bridgewater Treatise.*') Porter ('*Science and Revelation*,' p. 11), objecting to Faraday's view that atoms are "centres of force," says, "A centre of force must either be material or immaterial; if material the absurdity is as before, if immaterial no aggregate of the immaterial could form the material universe." This is a mere question of definition.

> "The self and the not-self," being "states of consciousness," that of them we cannot have "such unquestionable and immediate certainty as we have of the states of consciousness which we consider to be their effects." (§ 45.)

Self and not-self, "states of consciousness," "states of consciousness" resulting effects of the self and the not-self! is something like saying a reflecting object is the result of the object it reflects!

Consciousnesss as the mirror of the mind is in itself a unity; how that which is unity can be split into states is beyond my comprehension. We should not say a reflector is states of reflection, and by a parity of reasoning it seems impossible to say that consciousness, being the reflector by and through which impressions are received, can be split into states. Science talks of states of consciousness, but science is not infallible. There may be states of mind, because the mind is composed of many parts; there may be distinctive intelligences, because intelligence consists of degrees. We are conscious, or we are not conscious; this fact in relation to consciousness stands in the place of all its facts.

It is not because of the insight which has been achieved by the analysis of the substances surrounding us, or by deductions which announce that worlds have evolved from chaos;[1] that all we perceive and all we comprehend are questions of physics. The statical and dynamical are phases of phenomena, but the hidden energy which transposes and transforms defies the powers of analysis. In science, mechanical agencies find their expression and are intruded as causes, but the intelligence underlying all has no place in molecular physics, which, duly considered, if they have a place in a true system of nature, are found to be functional and determined by their law. The dogmatism of science reaches its climax when we are told, "No one possessing any knowledge of physical science would now venture to hold that vital force is the source of muscular power."[1] If this be the dictum of science, it becomes necessary to examine the data on which it is founded. Huxley says—

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[1] "Observation has never yet reached, or can ever reach, the development of a fiery cloud into emotion, intellect, will; phenomena of the human mind." (Porter, '*Sci. and Revel.*,' p. 28.)

> "The tendency to disturb equilibrium—to take forms which succeed one another in definite cycles—is the character of the living world." When speaking of vital action, he says that he cannot tell "the cause of the wonderful difference between the dead . . . and the living particle of matter, appearing in other respects identical." It may be there will "be discovered some higher laws of which the facts of life are particular cases," and that a bond will be found "between physico-chemical phenomena on the one hand and vital phenomena on the other; at present we assuredly know there is none." ('L. S.,' p. 76.)

The examination of this hypothesis brings us as a starting point to "the soul of the world," as an expression of universal vitality. We have Thales and his demons. The living active principle of Hippocrates called by him Nature, to which he referred all sources of motion. An analogy of this thought is found in the philosophy of Spinoza and in the expressions of Goethe, that God is everywhere in nature, not that the method of nature is God. Kepler and others have thought that the exposition of the methods of nature was thinking again the thoughts of God.[2] Pliny's philosophy was his theology, for to him motion, whether vital or physical, was a display of the divine energy. Socrates had a conception that the changes in nature could be explained without having recourse to the direct agency of the Gods (*vide* '*Clouds of Aristophanes*.') Aristotle has his *primum mobile* as the first moving cause. Plato recognised a Divine being.[3] Aristotle's idea became to him a soul, for the first moving cause was active in animate forms through the instrumentality of a principle distinct from the organism, and possessed an energy distinct from the organs through which it was manifested. It could receive nourishment, possessed sensation, motion, desire and intelligence.

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[1] "Dr. Frankland ascertained by direct calometrical determinations the potential energy locked up in a muscle, and in its chief products of oxidation—urea, uric acid, and hippuric acid—and proved that the store available was much less than would suffice to account for the work done by Fick and Wislicenus in the ascent of the Faulhorn. Frankland's experiments conclusively proved that the muscular force expended by the two Professors . . . must have been chiefly derived from the oxidation of non-nitrogenous matters, since it could not have been produced by the oxidation of the muscle or other nitrogenous constituents of their bodies." (*Vide* '*Nat.*,' vol. xvii, p. 319.)

[2] Persæus, a follower of Zeno, says:—"Those who have made discoveries advantageous to man should be esteemed as gods; it is not sufficient to call them discoverers of gods, but that they should be deemed divine." (Wheelwright's translation.)

[3] Plato, referring to the early traditions, says, "One God governed the universe; but a change taking place in the nature of men and things, the command devolved on Jupiter and other inferior deities to preside over different departments under him." ('Mitford's '*Greece*.')

In his idea this soul descended to vegetables. He had a definite idea that the muscles are the seat of the motive power, and that some nerves had relations to movement and others to sensation. From the period of Aristotle mythic hypotheses have been invented to account for vital action.

Von Helmont (with Paracelsus) held that the Archaeus (conscious and personal) accounted for all vital manifestations, and assumed the credit of distinguishing the specific characters of animate and inanimate nature. Stahl held matter to be essentially and necessarily inert, and that the powers of motion were derived from a special immaterial animating principle—*anima*,[1] "which does without teaching and without consideration that which it ought to do." Hoffman followed with "nervous influence" or "nerve fluid," having powers of action or tone, which may be increased (if unduly, spasm results) or diminished (if unduly, atony). Then came Glissen's doctrine of muscular irritability. Haller expanded the idea, and drew the distinction between the special vital properties of the muscles and of the nerves, retaining for the muscle irritability, for the nerve sensibility; for each property there was a something departing at death. The property was the life, of which, muscular contraction and nervation were acts. Brown added to the theory "stimulation," all things acting on the vital property acted as an excitant or stimulus.

After the time of Paracelsus the hope was excited that because of the great revelations made of the mechanical methods of the universe (Galileo, Kepler and Newton) "that the mechanical principles of the macrocosm would supply the key to all contained in the microcosm." Hence followed the material and mechanical theories, with which science is so much infested, the expectation being that they would suffice for explanation. Gilbert struck another path, he came to the conclusion that magnetism was the key to the vital movement,[2] but no fruit resulted until Galvani's accidental discovery. The movements he witnessed led him "to *divine*" that they were the resultants of animal electricity, due to the two kinds then known (vitreous and resinous)[3] and contained in the jerking limbs, and that the muscular fibres "were charged during rest as Leyden jars are charged"[1] and that muscular action was a discharge brought about by an electrical action of the nerve on the muscle. Volta was opposed to Galvani's views, his investigations led to the discovery of the voltaic pile and battery. Galvani continued his researches, Volta held that the contractions of the "galvanoscopic" frog were due to electricity arising from heterogeneous bodies in contact. Humbolt (1779) examined the question and held Volta was wrong in ignoring altogether the influences of animal electricity, and Galvani in recognizing nothing but this influence. Humbolt, although a believer in animal electricity, only rendered the theory highly probable.[2] The discovery of the voltaic battery set the subject at rest until 1827, when Nobili detected an electric current in a frog's leg by means of a galvanometer he invented, since perfected by Du Bois Reymond, William Thomson and others. Some years later a treatise of Matteucci led Du Bois Reymond to investigate the subject.

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[1] Erasmus Darwin calls this the spirit of animation.

[2] "I do not think the experiments conclusive of Galvani, Volta and others, they show a similitude between the spirit of animation which contracts the muscular fibre and the electric fluid. Since the electric fluid may act only as a more potent stimulus, exciting the muscular fibres into action and not supplying them with a new quantity of the spirit of life." ('*Zoonomia*,' i, 83.)

[3] (600 years B.C.) It was known a piece of amber rubbed acquired the quality of attracting light bodies. Gilbert showed that glass, resin, wax, &c., possessed the same power. Dufay caused a feather to be repelled by an excited glass tube "and intended to amuse himself by chasing it round the room with a piece of excited

sealing wax," but he found the feather was attracted, and he concluded there were two species of electricity, to which he gave the names vitreous and resinous electricity; they are also called positive and negative. He found them to possess the same general physical properties; they are self-repulsive, but one is attractive of the other. Early electricians observed the similarity between the phenomena of the electric spark and those of lightning. Franklin, intending to raise a pointed rod by way of attracting electricity from the clouds, hit on the idea of making a kite of a silk handkerchief stretched on a light wooden frame, and attached to it a hempen string terminating in a silk cord, to which he attached a key. During a thunderstorm he raised his kite, but no result was obtained until the string became wetted, when he saw the filaments repelling one another; on presenting his knuckle to the key he "received an electric spark." Franklin's theory assumes but one fluid, Dufay's two, Faraday has proved that the inductive action takes place in curved lines the direction of which can be varied by the approach of bodies. Radcliffe throughout his treatise distinguishes the forms as Franklinic and Faradaic.

[1] The gymnotus will deflect a magnetic needle, will magnetise a steel wire and decompose iodide of potassium. In an intercepted metallic circuit a spark was seen, and the induced spark was also obtained by a coil. The spark of the torpedo passes through conducting bodies, but not through non-conductors. Faraday experimenting on a gymnotus found the quantity of electricity passing at each discharge was equal to that of a Leyden battery containing 3500 square inches, charged to its highest degree, and this could be repeated two or three times without a sensible interval of time. The discharges were attended by nervous exhaustion.

High pressure steam escaping through a narrow jet will produce electric sparks many feet in length, probably due to the friction accompanying the escape by the action of minute drops against the tube. (*Vide 'Draper's Chem.,'* p. 143.)

[2] Erasmus Darwin says, "The alterations of electricity or magnetism do not apply philosophically to the illustration of the contraction of muscular fibres, since the force of those attractions in some proportion acts inversely as the distance, but in muscular motions there appears to be no difference in velocity or strength during the beginning or end of the contraction but which may be clearly ascribed to the varying mechanic advantage in the approximation of one bone to another, not to that of "cohesion or elasticity." "We must conclude that animal contraction is governed by laws of its own and not by those of mechanics, chemistry, magnetism, or electricity" (p. 82). "If nevertheless this theory should ever become established a stimulus must be called an eductor of vital ether; which

> West of Alford (1832) supposed "that the nervous influence which is present in relaxed muscular fibre is the only influence which the nerves of volition possess over that tissue, and its office is to restrain or control the tendency to contract, so inherent in the muscle, and that contraction can only take place when by an act of the will the influence is suspended, the muscle being then left to act according to its own innate properties." Again, he says "that nervous influence is imparted to muscular fibre for the purpose of restraining its contraction and that the action of the will and of all other disposers to contraction is simply to withdraw for a while this influence so as to allow the peculiar property of the muscular fibre to display itself." Bell is reported to have said "that relaxation might be the act, and not contraction, and that physiologists in studying the subject, had too much neglected the consideration of the mode by which relaxation is effected."

Later, Duges held "muscular contraction exists only by the annihilation of expansion."

C. B. Radcliffe has contributed an important memoir on the subject ('*Vital Motion as a mode of Physical Motion*'), a scientific and practical application of S. T. Coleridge's idea that electricity was the method of organised function ('*Theory of Life*').[1] If from Radcliffe's title the idea is to be gathered that physical motion is the forestaller of vital motion the casual is made the actual. That nature works by the forces (correlated) as her

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stimulus may consist of sensation or volition as in the electric eel, as well as in the appulses of external bodies; as the drawing off the charges of vital fluid may occasion the contraction or motions of muscular fibres and organs of sense." ('*Zoonomia*,' p. 84, vol. i.)

[1] Sulzer (early in the 18th century) observed when silver and zinc are placed above and under the tongue, the metallic edges being in contact, a metallic taste is obtained. This is the first record of voltaic electricity. Galvani supposed the convulsions in the limb of a dead skinned frog, when a metallic connection was made between a nerve and muscle, arose from the muscular systems of animals being constantly in a positive electrical state, the nervous system being negative. Volta, on the contrary, held that these convulsions were not due to any peculiarity of the animal system, but to the contact of the metals employed. Erasmus Darwin, commenting on these effects (the experiments of Sulzer apparently being unknown to him), says Volta experimented with clean lead and silver, placing one above and one beneath the tongue; on contact of the metals a saline or acidulous taste was perceived, "as if a fluid-like stream of electricity passed from one to the other." Galvani, Fowler and Volta found silver and zinc more effective; by placing a lozenge of one metal above and the other beneath the tongue, on contact a taste is perceived. If one of the metals be placed between the upper lip and the gum of the fore teeth and their external edges be brought in contact in a darkened room a flash of light is perceived in the eyes, showing "the great sensibility of these organs of sense to the stimulus of the electric fluid" in suddenly passing through them (*vide* '*Zoonomia*,' vol. i, p. 164).

If Radcliffe's ably conducted experiments be accepted as proof that muscular action is the result of electric action, it is probable the effect on organs of taste and sight may be due to a similar agency and that electricity plays a greater part in nature's methods than has been heretofore conceived. We can only suppose that the vital fact exemplifies its energy by physical means in its application to the animal economy. Whatever be the physics of the mechanism, they can but be conducted by waste. The vital energy using them as its methods *repairs the waste and thus excludes all idea of physical force* (*per se*) *being the initiatory impulse.* If vital action resulted alone in mechanical motion it might be said that muscular force was physical force; but no physical force reproduces itself.

method is undoubted, hence it follows that the physical fact is a resultant of the vital fact, the universal principle in nature. In nature there is no distinction between the minutest material particle and the most perfect of composite forms, except in the conditions due to the aggregation and disposition of the particles. If the vital motion of man be manifested through electrical agency the same force is effective in the protamœba and even in cells; the cellular fact is a polar fact, and hence an electrical fact, or its differentiation. The vital fact *has formative* besides motive functions. The electrical, mechanical, and chemical amalgamations produce objective phenomena; by the consideration of them an insight is given into the working methods of nature. It is more than doubtful, were there no vital principle as a directing agent, whether nature could be. These considerations show nothing of the interactions of interior principles. When analyses are made there are no disclosures of vitality, intelligence, or consciousness, or even of sensation, or the reason for the cohesion of particle with particle or whence by the interactions of force the differentiations we trace in the infinite variations of phenomena arise. Can we then say we have a knowledge of facts? or shall we not say the knowledge we have attained is that of our ignorance of the ultimate impulses of nature?

Radcliffe appears to have said all that can be said of physical motion, and has said it well. Accepting all his facts, he nowhere explains what vital motion is; but it must be conceded he discloses a method of its action, viz. that the physical motion of animated life is derived from vital motion and is not a creator of vital motion, and unless his title contains an *equivoque* it inaptly presents his subject, suggesting the idea that vital motion is the casual and physical motion the actual. His mode of treatment utterly destroys the assumption of Frankland (*suprà*), and if the reasonings are adopted it must henceforth be said *that vital force is the source of muscular power.* He concludes by saying (p. 183)—

> "In point of fact, electricity and elasticity would seem to be everything in vital motion, and vitality nothing. In saying this about electricity, however, I have no wish to elevate that which is physical at the expense of that which is vital. On the contrary, I firmly believe—and with this remark I bring to a close what I have to say upon vital motion in its physiological relations—that which is called electricity is only a one-sided manifestation of the workings of a single, central, cosmical law, which, when fully revealed, will be found to rule living and lifeless bodies alike, not by entombing spirit in matter, but by transfiguring and spiritualising matter—a law which without confusion of substance binds all things together in the very closest communion—a law which makes the old belief of multeity in unity and unity in multeity a sober fact."

There is the same confusion here so obvious in other treatises, the confounding the perceived with the conceived. The method of the work is the perceptive; the underlying element, inducing the work, the conceptive. When all is said which physical considerations can say, we have man (in his two or combined phases of being—the perceptive and conceptive), *the thinking presentment of an organic fact.*

Physicists and chemists work by way of analysis. The philosopher accepts the facts and subordinates all to principles, for every object and living form, rightly understood, contains within itself the past history of the world. Organization as a vital fact is the expression of its work, as intelligence is digested thought. Reasonings fairly conducted open up truths whereby seeming facts, long accepted as truths, are overthrown by the slow march of induction. Copernicus prepared the way for Galileo, he for Kepler, and Kepler for Newton. Newton, by the discovery of the laws of gravitation, opened out a vast field for inquiry and gave scope for speculation, out of which eager thinkers constructed a scheme or foundation for Kosmical science. The speculations of Kant and Laplace led to the nebular theory, in the same way as the theory of light and Newton's observation of two lines in the solar spectrum led to the development of the present system of spectral analysis which discloses the elemental compounds of suns and planetary bodies. The minutiæ of parts are but the stepping-stones of construction, the underlying energy moulds and fashions, and from heterogeneity produces homogeneity by the imperative force of law. Physics disclose the faculty of being adapted; the potence discerned in physics thus becomes that inner capability we know as vital energy.[1] Allow the physicist to construe the theme, and intelligence is but a problem of molecular physics.[2] No experiment has yet proved that vital and physical forces are the same. The muscle lengthens or swells through vital action.[3] If this lengthening and swelling were mere physical results, why does the innate, or we might say the self-active power cease when the life is withdrawn?[1] The materials are present, but their elasticity has passed away. If we collate the facts, what do we find? Vital force as the inherent fact of all things; physical or material force but a consequence of the organization. Vital force originates, physical force acts only through an impulsion. Vital force congregates, disintegrates, and multiplies itself; physical force acts only in masses through gravitation. Vital force cannot be originated, nor its issues directed; but physical force may be directed and called into action at will, and may be made the plaything of the hour, as the incitation of muscular elasticity after death. By some it has been said that catalytic action is allied to, if it be not of the same nature as fermentation. Fermentation is the result of a living organism, and its changes are self-multiplication, not due to the mere dissolution or disintegration of the parts. There may be decay without putrefaction, but no putrefaction can occur without the presence of living particles (*Pasteur*). Catalytic forms have *no power of self-multiplication*, the living *always* have. The changes " in the living cells show that life involves more than chemical, mechanical, and catalytic changes, or of the whole together" (*Beale*).[2] An organic compound and an organism can be presented in their original constituents; the first has the capacity of life, *i.e.* the possibility of being the life bearer; the last possesses the life fact, affording proof that the objective presentment of the elements in combination constitutes merely the vehicle through which vitality is manifested.

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[1] All vital acts are associated muscular facts, as when the arm is extended to a distant object other muscles come into unconscious action in order to preserve the centre of gravity. So when threading a needle, the pectoral muscle is brought into action to preserve the trunk of the body motionless, and for the moment respiration ceases. (*Vide 'Zoonomia,'* vol. i. p. 59.)

[2] "The assertion that the universe is self-existent does not really carry us a step beyond the cognition of its present existence, and so leaves us with a mere restatement of its mystery." ('*First Principles,*' p. 32, Spencer.)

[3] Bell, speaking of the muscular action of the eye, says—"When men deny the fine muscular adaptation of the eye to the sensation on the retina, how do they account for the obvious fact that the eyeball does move in such just degrees? How is the one eye adjusted to the other with such marvellous precision? And how do the eyes move together in pursuit of an object, never failing to accompany it correctly, be it the flight of a bird, the course of a tennis ball, and even of a bomb-shell. Is it not an irresistible conclusion that if we follow an object, adjusting the muscles

It were better to accept the dogmatism of Theology as the social rule than that of Materialism. The former has at least its check in the communion of belief, the latter has no check; for it is not to be supposed that the multitude have attained to such

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of the eye so as to present the axis of vision successively to it as it changes place, we must be sensible of these motions? for how can we direct the muscles unless we be sensible to their action? And must we not have a conception of the relations of the muscles and of the position of the axis of the eye before we can alter its direction to fix it on a new object?" (' *B. T.*,' p. 287.)

[1] Muscular fibre ceases to have irritability after death, but retains its elasticity, as shown in a harp string—a rude stroke and it becomes relaxed and has no energy to regain its former position; in the living fibre the elasticity is restored by vital action when relaxed by too continued a strain. (Bell, ' *B. T.*')

[2] "If the vital actions of man's frame were directed by his will, they are necessarily so minute and complicated they would immediately fall in confusion." " A tracery of nervous cords unites many organs in sympathy; if one filament were broken, pain, spasm, and suffocation would ensue." The action of the heart, the circulation of the blood, and all vital functions are governed by laws not dependent on will, and to which the powers of the mind are altogether inadequate. A *doubt*, a *moment's pause of irresolution, a forgetfulness of a single action at its appointed time*, would terminate life. (Bell, ' *Brid. Treat.*,' 10.)

culture that philosophical dicta would be adopted as the rule of conduct. Buddha is explicit on the point.[1]

Burdon Sanderson and Tyndall, however they may differ in definition and explanation, agree in describing germs as inappreciable by the highest powers of the microscope, and even go so far as to assume them to be atmospheric specks. What conclusion can be drawn other than that the germs are not in themselves existing composite forms, but that they are elemental units which, by an interaction and in an aggregation cement their life facts producing their like, as active organizations, or by contact with the juices of an organization producing morbid action. Pasteur by his series of experiments showed that the infections of the vine and silk worm arose from germs.

The processes of Tyndall were directed to the mere question of spontaneous growth, and he claims to have proved there is no such thing by ignoring the processes of nature. The methods he pursued are the same as those of Bastian and others. The later experiments on urea (Bastian) seem to have excited the attention urine of Pasteur.[2] There are no repeated boilings in nature, nor an exclusion of the elements of the protoplasm, which lives only by contact with environments filled with vital energies. The germ, whatever it be, is the car of vitality whereon it is triumphantly borne to consummate its conquests. Nature works in her own mode, and all these experimental distortions of nature's course appear to show *that the law of nature is the spontaneous inrush of life.* Creation, or whatever the name most fitting, was accomplished once for all; the first consolidated mass—jelly spot or germ—contained within itself the vitality which became the life.[3] According to the general theory the Kosmos arose from a consolidation of igneous vapour.[1] From such a state it is difficult to understand how the life emerged. To adopt the igneous theory, all we know of space, that Vast which glows with orbs filling the arc of the sky, spanning distances represented by numbers the mind fails to grasp, was once a glowing fiery vapour. If this were the state of the sun and his system, it was that of all other suns and cycles of suns and astral systems, heat in its extreme aspect supreme as substance. If the law of combinations be followed, we find the elements existed in a fluid form; through condensations, aggregations, and cohesions by affinities, the germ was developed and the earliest animated forms appeared; *the rocks were the results of the life thus generated.* Science teaches, the polype deposits chalk, carbon in precipitation, absorbed from the surrounding fluids. There is also the globegerina ooze. Wyville Thomson was inclined to suppose that the red clay found on the bottom of the ocean resulted from it. The idea was dispelled when the naturalists accompanying the Challenger expedition proved it to be mainly due to decomposed and disintegrated pumice, through the action of sea water.[2] The flints are due to the sponges.[3] Infusorial and the early forms of life,

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[1] "It is better to believe in a future life in which happiness or misery can be felt; for if the heart believes therein, it will abandon sin and act virtuously; and even if there be no resurrection, such a life will bring good name and the regard of many; but those who believe in extinction at death will not fail to commit any sin that they may choose, because of their disbelief in a future; and if there should happen to be a future after all, they will be at a disadvantage, they will be like travellers without provisions." ('Wheel of law.')

[2] An investigation of Bastian's process was proposed. Pasteur, Dumas, and Milne-Edwards were appointed as judges. Through certain preliminaries insisted on, the investigation was deferred.

[3] It is assumed pangenesis is incompatible with scientific analysis, yet physicists are compelled to admit that microzoa float in the atmosphere. Of this character are the invisible atmospheric germs of Tyndall and Burdon Sanderson. It is amusing to note the struggles to maintain hypotheses which deny on the one hand the spontaneity of life and universal vitality, yet on the other gravely assume invisible atmospheric living germs. This vitality pervades air, earth, and water; the plasma materials are everywhere. Vitality engenders other vitalities—a parasitic life exists in vigour in the interior of animals and plants; not alone in cavities communicable with the outer world, but in parts closely sealed from contact with air, as the worms

in sheep's brains, and the *Trichina spiralis* invading fleshy structure. Pantheists may be excused for assuming the universality of life—all the earth, as we know it, is composed of once living *débris*. They erred in supposing spontaneity to be the originating cause; but for the ultimate impulse directed by intelligence, the universal chaos would have stagnated even although interpenetrated by a seething animation.

[1] The prevalence of heat as a principle in nature is proved by the ready production of combustion; by the concentration of the sun's rays a substance may be inflamed; by the compression of air in a glass cylinder by a piston, tinder or phosphorus attached to it is ignited; by pouring concentrated nitric acid on oil of turpentine, by the trituration of phosphorus, by directing a stream of inflammable gas on particles of phosphorus; and by passing an electric current along a wire by means of a voltaic apparatus, &c. &c.

[2] The Challenger researches show the ocean, even in the lowest depths, has a life of its own. Ross procured living infusoria from the bottom of the Antarctic Ocean, and more than fifty species with siliceous carapaces from the floating ice of these seas. In the Gulf of Erebus seventy-eight species of siliceous infusoria were brought up from a depth of 1500 feet, and infusoria have been found at the depth of 12,000—a pressure of 375 atmospheres.

[3] Sponges (*prorifera*) are classed as animals, and are met with in all shapes, sizes, forms, and colours—Neptune's glove, sea muffs, sea tapers, the cup of Neptune, &c. Generally they appear to be gelatinous masses supported by a network of horny filaments, or calcareous or siliceous framework; in their natural habitations they are full of life and action. Of organs there is no trace. Some have little hollows or fibres of flint, so fragile as to break on the least pressure. Many naturalists suppose the flints in chalk are the *débris* of sponges. Their remains are found in jaspars and agates. The spiculæ vary in shape; some have simple translucent bars, others are like rough flints rendered transparent, others star-shaped with several points. The greater number of them appear as knotted clubs of different coloured glass. The pumice stone sponge (*dactylo chalix*) is an agglomerate of spiculæ, and

even as high as the crustacea, have swollen the mass of deposits by their remains. The great fact of all is that these deposits, in one mode or other, are composed of the skeletons, secretions, and excretions of infusoria, and the simplest forms of life. Mountains are heaped up by their remains; they face us in every strata where oxydized carbon is the predominant constituent. In the depths of the sea, far beneath the influence of the direct rays of the sun, we find the foraminifera, or their remains; a crawling life, and eyeless creatures; high on the mountain heights, even on their most elevated points, the foraminifera and kindred orders meet us. Schemes of creation and hypotheses of the advent of life on the earth are many; we have the theocratic idea of direct manipulation,[1] and we have the astounding proposition of a distinguished physicist that the precursor of life on the earth was the advent of a lichen concealed in the crevices of a fragment of an exploded world. The lichen would have been inoperative unless the fungus had accompanied it. If the life was borne on the fragment of an exploded world, from whence was the life imparted to the first world coagulated from the igneous fluid? The only reasonable explanation of the presence of life on this globe is that of a vital spontaneity. Science regards with indifference the theory of men developing from apes, and of automatic man, and with complacency regards the materialistic theory that from matter we have "all the forms and qualities of life," through its own inherent power. Spontaneity, whatever it may mean, was doubtless the fact of creation; law formulated the fact, and the beginning is the continuing present. In our ignorance of real causes, the hypothesis of spontaneity points to that beginning of life from which all the facts of science converge.[2] We do not expect to see the rock become a man, but we do find the beginnings of life in the organless jelly spot. *Law*, *con-*

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resembles a madrepore rather than a sponge. It is hard and stiff, as though carved from stone, and yet so porous as scarcely to weigh more than a similar bulk of cork, and it is formed entirely of silex. The reticulated structures are transparent glass tubes, the silex forming the mass itself not being arranged as spiculæ. It is perfectly rigid and sonorous when struck. Sponges are numerous; myriads of gemmules pass into the sea from every sponge inhabiting its waters. "So numerous are they and so marvellously prolific, the wonder is that they do not swarm to such an extent as to fill the oceans and poison the whole earth by the odour of their decay."

[1] The Chinese represented the first organizer of chaos as a feeble old man (Pan-Kou-Ché) toiling painfully at his work, carving out the crusts of the globe, at the same time clearing a path through a wilderness of rocks. The Scandinavians made their god (Thor) mighty and redoubtable, endowed with an invincible energy, who with his hammer crushed and scattered the crusts of the earth, forming from the splinters mountains and rocks.

[2] Immensity everywhere, revealed in the sky, where glow a dust of stars, and in living infusoria too minute to display their organization. (*Pouchet, l'Univers.*)

sidered as the ideal of intelligence, is the insisting fact of all nature, and that which at any time was the result of its action is the continuing fact, or all human science and human knowledge becomes a bundle of contradictory absurdities. When formation by sequential differentiation is considered, the kosmic theory of Kant and its more definite mathematical expression by La Place—viz. that the earth is due to the condensation of igneous vapour, a mass of heterogeneous gaseous substances in a state of violent ignition—appears open to grave doubts. Given heat as a distinct principle from its action we can view the emanation of objective phenomena, and conflagration becomes, as it continues to be, the casual exhibition. It appears improbable that a universal conflagration ever existed. The hypothesis is that the covering or envelope of the sun is flaming hydrogen in a state of violent combustion, but within it, floats the opaque ball, the true sun which the Herschels, Arago and Figuier supposed to be or might be inhabited. If their ideas be more than hypotheses, the seeming flaming hemisphere, which human ingenuity has found the means of inspecting, will receive another solution. It is impossible to conceive that an igneous mist, a flaming chaos of red hot elements, could ever have been the state of a life-bearing orb. Passing over the question of a primordial element we can say the elemental gases, metals and metalloids, were a mingled chaos permeated by heat, and that through some counteracting power the gases combined and the denser portions were precipitated as a fluid. We then get a floating liquid orb with no solid in its sphere, surrounded by a gaseous envelope of mingled elements which eventually succumbed to vital energy.[1] Protoplasmic elements cohered and jelly specks floated amid this partly condensed fluid sphere, and congregated in millions and multiplied in myriads of millions ;[2]

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[1] "Everywhere throughout our planet we notice the tendency of the ultimate particles of matter to run into symmetric forms and that the very molecules are instinct with a desire for union and growth."—*Tyndall at Manchester.*

"With each new implement (mechanical structure) visible externally, there are a thousand internal relations established ; a mechanical contrivance in the bones and joints which alters every part of the skeleton ; an arrangement of muscles in just correspondence ; a new and appropriate texture of nervous filaments which is laid intermediate between the instrument and the very centre of life and motion ; and finally new sources of activity must be created in relation to the new organ otherwise the part will hang a useless appendage."—*Bell, Brid. Treat.*, 148.

[2] "So rapid is the progression of infusorial life—Ehrenberg calculated one of these invisible creatures, of $\frac{1}{4600}$th of an inch in extent, became in twenty-four hours (by fission) a million, and in four days one hundred and forty billions, a bulk nearly equal to two cubic feet ; if the four days were multiplied by the eras of geology masses are disclosed which would construct thousands of worlds. Rechus showed that the mud of the harbour of Weimar (composed of half or a third of existing species) accumulates so immensely that in a century they probably will

by secretions from their environments and from dead carcases, infinitesimal in size, masses were formed which would obey the law of motion incidental to inanimate substances collecting in a body by mutual attractions[1] and by the action of the correlated forces cohesion would be manifested in the mass. Time being of no account in the tremendous impulse, the heterogeneous became the homogeneous, chaos became order. The mass, heat impregnated would display unequal distensions and chemical contentions, whereby swellings and eruptions would ensue; the coagulated and aggregated mass would assume all shapes compatible with that of a revolving sphere, and from the heat generated, protrusions, hollows, and fractures would arise, which the waters would fill and form oceans and rivers, and interior forces would be initiated such as the earth experiences. Were it not for those forces, instead of the successions of heights and hollows, there would be a smooth water-washed surface which the ebb tide would leave bare and the flood submerge. In such a state, life in its multifarious variety and in its active manifestation would be but sparingly exhibited. Following the phases of the geological eras in the deposition of strata, the simplest life-facts are first presented, and as the environments become ameliorated so the life presents itself in a higher form. Every departure from the chaotic admixture presents the life-facts lit up by a new energy. Differentiations and the admixture of elemental substances would account for the composition of the various rocks, and the infinite

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represent a million cubic yards. On the heaths of Luneburg there are beds of these accumulations of large extent, forty feet in thickness. In America such beds are found twenty feet thick. Berlin is built on such a bed. The tripolis (siliceous rocks) are almost exclusively skeletons of *Bacellaria. Mulliolæ* are heaped as mountains of limestone. *Nummelites* form the chain of mountains which extend along the Nile. The sphinx and pyramids are formed of them. The edible dust found in many parts contains numberless species of infusoria (Retzius). The life in the early geological eras leaves everywhere its mark on the strata. The calmness of the sea was coequal with the fecundity. There are deposits of shells which show no mark of erosion, retaining their delicate projections and almost imperceptible striæ and still glowing with colour. Again, there are deposits crushed and broken, precipitated into a tumultuous sea and then elevated. Mollusks are piled in masses deep in the strata and upreared as mountains. Shells, corals, animalculæ, or their remains, everywhere abound. Mountains of chalk are the débris of sponges and invisible foraminifera, encircling England, abounding on the Volga, in the north of France, Denmark, Sweden, Greece, Sicily, Arabia, &c. The strata of the earth capable of inspection are found to be composed of once living things and the ground-worn particles of the plutonic rocks, and from which all marks of life are erased. Look where we will it is life or its remains!"

[2] Maury in proof of his hypothesis of the collection of the weed in the sea of Saragossa says: "If we throw into a vessel of water pieces of cork, grain, or any other floating bodies and communicate a rotary movement to the water, all these light bodies will collect towards the centre because the water is less agitated there than elsewhere."

variations of their admixtures. This hypothesis presents a picture more in accordance with scientific advance than that which a flaming incandescence presents.

Fontenelle insisted intellect should be solely occupied with facts out of which grow all philosophy as a subject capable of universal application ; we may say all we know of objective forms is comprised in three grand generalizations—Malpighi's littles, Grove's correlation[1] (transmutations) of forces, and Darwin's evolution (developement). All substances are particled, and when acted on by forces, they develope into masses ; this is the method of Nature ; its continuity, due to recuperative energy. It is more consistent with the revealed facts that animation arose from an unbounded vitality, which energized as it produced, than to suppose all we know of animated nature are condensations from a fire mist. Conflagration produces but incandescence, a disintegration of masses ending in a gaseous exhalation ; the greater the heat the wider the interstices between particle and particle, and as space is an expanse, there could be no *bounding* lines.

In infusorial life we have an invisible world, as mighty and grand as that of the seen.[2] Such a history announced before the application of the microscope would have been considered as the dream of lunacy. The discoveries of science are but perceptive infinitesimals, worthless without intelligence as an interpreter. Science has growth ; nothing in it is final.[3] Pythagorus, hundreds of years before the Christian era, sketched the planetary system, Ptolemy and Copernicus attempted to revive his theory; but not until Galileo stretched his tube towards the skies did the system gain credence. When Newton mathematically worked out his theory of gravitation, the motions of the heavens were assumed to be ascertained facts. The same inherence and relation which particle has for particle find their counterpart in the spinning orbs, wheel within wheel, in endless whirr, interlacing and combining by polar influences (magnetic), a dependent and depending animation expressed as motion. Magnetism within and around us, Galvani's accident gave the clue to the mystery which Volta unlocked; Gilbert had before divined such action, but there were no implements to test his conjecture and when there were, long years passed before Faraday showed the relations of electricity to magnetism. The vital unseen being so wondrously defined, can we say there is nothing beyond the world we perceive, a world of existing and intelligent power beyond that in which we live and assume to know. There is no implement to probe its depths or reveal its wonders. There may exist spiritual things around and about us of which we are as unconscious as we were of the world of the animalculæ. One well-authenticated and scientifically evidenced spiritual fact would do for the intelligent unseen what the microscope, the telescope, and Voltaic-cell did for biology, astronomy, and electro-magnetism. The boast of Tyndall at Birmingham, the

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[1] If the true emphasis were given by science to this theory, we should miss much of the *erudition* we meet with to account for the changes of climate in the early geological eras, as changing polar positions, inversions of the eqninox, oscillations, a cooling earth and sun, viscosity of the earth, &c. &c., so scientifically demonstrated. The transfusion of the forces would simplify our conception of facts, and probably throw some light on this very obscure question.

[2] For a long time after infusoria were discovered it was supposed they had no organization. Gleichen stained some water with carmine in which were some, and was astonished to see them glowing with colour. The significance of this fact long escaped the naturalist. Ehrenberg demonstrated that many of these creatures had complicated internal organization. Some have twenty or more stomachs (microzoons), others stomachs with teeth. Others have eyes presenting flame-red pupils, others cavities representing hearts. The *protei*, like the white blood-corpuscules, change their shapes—now globular, now three cornered, now star-like. &c.

There is as much relative difference in size between a monad and the hooded colpodos as between a mouse and a mammoth. Ehrenberg, from his observation of the infusoria, supposed them to be in incessant movement, taking neither sleep nor rest. Owen supposed this to be due to the great development of the digestive powers. Some are cased in mail formed of silex, and are infinitely diversified in form.

[3] The coral of commerce was long a mystery. It has a long branched stem beautifully red in colour, found in great ocean depths, its branches covered with rose-coloured bark, display here and there small holes ; these are the habitations of the polypi, which, when expanded, appear like flowers of a delicate white colour, in

eight divergencies, spread raylike with fringes of cilia. Tournefort took it to be a plant, Marsigli announced he had discovered the flowers of the coral and sent a specimen to the Academy of Sciences, and it was supposed the question was settled. Peysonnell discovered the flowers to be so many polypi, the builders of the stone shrub. He made his discovery known to the Academy, and in return received insult. Réaumer wrote to him in a tone of pity and irony, Jussieu contemptuously. Peysonnell, in disgust, forsook his native land, and died an exile. Eventually, on investigation, it was found the obscure French physician was more learned than the Academy. Nicolai put to rest for ever the absurd myths relating to coral being limp and flaccid in water, but hard in the air. He descended to the sea bottom, and found it was stone in water as in the atmosphere. Duthiers found the polypi imitate the sexual dispositions found in certain plants. Some are male, others female, and others hermaphrodite. The eggs are spherical, of a milk white, and almost as soon as issued move about to seek a favourable site to establish themselves. The polypi by their labours have raised the sea's bottom, and brought about various changes (by their calcareous buildings) in the crust of the globe.

The powers of these "builders of worlds," as Michelet calls them, recast and changed the surface of the globe in antediluvian periods. The inhabitants of Suez and Djeddah build their houses with masses of madrepores obtained from the Red Sea (Forskal). Bolta says the Sandwich Islanders use them for the same purposes.

Our palaces, monuments, and statues are the carcases of animals which played their part in life in æons of geological eras. Whatever our habitations, whether timber or brick, all are composed of once-living forms.

assumptions of Huxley and Haeckel will never be realized until we go behind perception. With that only as our working fact, we have as an axiom "*ignoramus ignorabimus;*" when we pierce the ideal and the scientifically unknown we may say, "We know, and we shall know."[1]

Through the minute and invisible, through an unceasing vitality, with its adjunct—heat, earth assumed its form. Heat, expressed as animation, is soothing and developing; as electric action, condensing and changing; in excess destroying and re-forming. Thus we might run the round of all the correlated forces. When we have thought all we can think, and proved all we can prove, *we have alone spontaneity through the impress of law.* We may formulate theories, and when all is done we arrive at Hume's probable possible. Whether we test the air, the waters, or the rocks, we find life or its remains, giving significance to Shelley's idea, "that every grain of dust was once indued with life."[2]

The hypothesis cursorily sketched may reconcile catastrophism, uniformitarianism, and evolutionism, or may be claimed by either or by all. Over it the theologian and materialist might shake hands; for on the one hand it may be said that the earth emerged from the chaos of darkness by the fiat of an Almighty and Intelligent Will, and life became its fact by the institution of Law. And on the other hand that this was accomplished by the direct ordination of mechanics and chemistry as the method of nature through vital evolution.

Of Deity we can have no exact knowledge; we see in nature a working intelligence coextensive with phenomena, and find thereby an active interposition resulting in homogeneous order. Call this law or aught else, it is individualised in its facts. Whatever it may be, we can neither add to nor diminish the reality. This Intelligence must count for something in the order of nature; if for something, then for all things.[1]

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[1] Pouchet says, "I never see one of these gigantic sponges (Neptune's Cup) without humbling myself before the wisdom of Providence. This monumental structure is erected solely by myriads of polypi, fragile creatures shrunk within their holes to plunge their imperceptible arms into the waves. And who directs and guides the invisible hands of these polypi, separated from one another and often a yard apart, so as to give their works such harmonious symmetry? Who, when the narrow stalk is finished, tells its population that from henceforth they must widen it? Who tells them when the time is come for hollowing the vase, and when it is the season for thinning its edges and adorning the exterior with elegant ribs? And, lastly, what supreme inspiration teaches a multitude of workmen, so scattered, and all caged in their little cells, that they mould the cup in all its artistic proportions" (*L'Univers*). "This magnificent construction is the noblest challenge one can offer to the schools of materialism. Do physico-chemical sciences explain how these animals communicate with each other so as to finish their common habitation, for it is absolutely necessary that all should be governed by one dominant idea" (*Ibid.*). The same idea may be extended to the germs of which all animal forms are composed.

[2] The flashing phosphorescence on the surface of the ocean is due to minute creatures. *The miliary noctiluca,* a tiny jelly speck, with numerous points and filiform appendages, plays a great part, as also the *medusæ* or the *physophora,* trailing tresses spangled with stars like those of Berenice. Midden found the blood-showers and red snow were due to twenty species of animalculæ and as many microscopic plants. Humbolt says that each bed of ocean is peopled with animalculæ to depths exceeding the highest mountains.

The dread of the unseen found with uncultured races and the idolatry of the cultured enthusiast has its origin in the same root. The solution of philosophical ideals and the extremes of theological dicta are found in that inherent sentiment common to the races of man, the sense of an existence without and beyond us—the presence of a life beyond the life we live. The first man who regarded the sun as the ruling principle of nature gave being to the intellectual sentiment expressed as religion.[2] The amplification of the idea is found in the theologies of civilization, in fact there is but little distinction between the fetish and relic, or between the rude stone of sacrifice and the gorgeously decked altar.[1]

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[1] In the Vedic poems, of Chaos, or the beginning, we read, " Nothing that is was then, even what is not did not exist then, what was it that hid, or covered the existing? What was the refuge of what? Was water the deep abyss, the chaos which swallowed up everything? There was no death, nothing immortal. There was no space, no life, and lastly no time. No solar touch by which the morning might be told from the evening. That one breathed, breathless by itself; other than it, nothing has since been. That one breathed and lived; it enjoyed more than mere existence; yet its life was not dependent upon itself as our life depends on the air we breathe. It breathed, breathless. Darkness there was, and all at first was veiled in gloom profound as ocean." (*Hist. Sans., lit, Max Muller.*) In the Vedas there are other grand expositions of thought which may have afforded the nucleus of myths and theisms. As a pervading idea, " there is the expression of one supreme being in all and above all."—(*Talboys Wheeler.*)

[2] Dupuis (' Origine des Cultes') held the hypothesis that all religious belief arose from the worship of the elements. " Light and darkness, its perpetual contrast; the succession of days and nights, the periodical order of the seasons; the career of the brilliant luminary which regulates their course; that of the moon his sister and rival; night and the innumerable fires which she lights in the blue vault of heaven; the revolution of the stars which exhibits them for a longer or shorter period above our horizon; the constancy of this period in the fixed stars and planets; their direct and retrograde course; their momentary rest; the phases of the moon waxing, full, waning, divested of all light; the progressive motion of the sun upwards, downwards; the successive order of the rising and setting of the fixed stars which mark the different points of the course of the sun, whilst the different aspects which the earth daily assumes mark here below also the same periods of the sun's annual motion....All these different pictures displayed before the eyes of man, form the great and magnificent spectacle by which I suppose him to be surrounded at the moment when *he is about to create his gods.*" Hume says, "The first ideas of religion arose not from a contemplation of the works of nature, but from a concern with regard to the events of life, and from incessant hopes and fears which actuate the human mind" (*Nat. Hist. Rel.*, p. 13.)

It was the conviction of something divine which gave permanence to the mythic gods. " The early thinker necessarily invested all external objects with properties and qualities similar to those he assigned to human beings, and these actions he assigned to human motives. Sun, moon, and stars seemed living beings; flames, streams, and winds were supposed to be moved by feelings such as those known to move animals and men."—*Philos. of Mind*, p. 307.

The act of reverence in the bended knee and the utterance of prayer were sympathetic expressions of human sentiment originating from the ideal conception of an unseen power, and thus becoming the intellectual communion of affinity—spirit seeking spirit. So true the conception, man universally adopted it. The bended knee is the symbol of dependence and propitiation. Weill (*Moise et le Talmud*) says "in the Mosaic law there was no idea of prayer, intercession, or pardon." This conclusion appears to receive countenance from *Luke* xi, 1, where one of the disciples said to Jesus, "Teach us to pray." He gave the form, in which there is not a single supplication for spiritual blessing or for salvation.

All the great religious reformers appear to have been impressed by the idea that they were expressly selected by God for the office, and assert that they were either in direct communion with Deity or subjected to such an influx that the system they promulgated was the direct announcement of the will of God. Buddha assumed to have achieved the position of Deity by means of his austerities. The followers of Jesus Christ assert that he was the Son of God, and co-equal with God.[2] He embodied a great philosophy—when he proclaimed the Sonship of man and the Fatherhood of God. Whether he said he was the Son of God in any other sense than that all men are the sons of God is a subject of controversy. By proclaiming the Sonship of man and the common Fatherhood of God he showed the intellectual kinship of man. Buddha, taught that all creatures were entitled to the consideration of man; that cruelty to them was a crime against the divine nature, and subjected the perpetrators to a metempsychosis wherein they would experience a thousand-fold the cruelties they had inflicted. He inculcated purity of thought and act, and the denial of the amenities of life as the means of attaining to Nirvana. He imperatively stamped his sincerity by abandoning an august position, and becoming a wandering fakeer. The new thought inculcated by Jesus was the kinship of man; by Moses the institution of the Sabbath; by Zoroaster, the immortality of the soul; by Mohammed, the continuation in a life to come of sensory pleasures. In the parable of Lazarus and Dives the sensory fact of pain in the life to come is delineated. If there be pain, it is probable there will be the sensory fact of pleasure—the more agreeable doctrine; yet this is pointed to as a fatal blot in the Mohammedan creed. If the life to come be of pure intelligence or spirit, it is difficult to conceive the presence of the senses as we understand their action. The moral precept of duty, Do unto others as you would they should do unto you, is the inculcation of all the teachers. Its earliest expression, as an axiom of conduct, is found in the writings of Confucius.

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[1] "The garlands which adorn a martyr's tomb cannot thrill with pleasure the decaying corpse within." They may serve as beacons to the living, or as incitations to an idealism which presupposes that all acts of life but subserve the life to come and that an eternity of pleasurable bliss is concentrated in the contemplation of ineffable Deity, and lead to a faith built on a code whereby the selfishness of the human is merged in the enjoyment of the divine. When all is said we have but *the fetish* as an appreciation of the unseen.

[2] Indra deposed Dyaus, Jupiter Chronos, Jesus Jehovah.

The teaching of modern spiritualism is, that in the future the spirit will be instructed until the utmost knowledge and the utmost purity is attained; as then only the spirit can endure and enjoy the presence of Deity.[1] Systems of theologies are really philosophies suited to the mental conditions of the period of their institution, and are usually tainted with the sense expression of the nation wherein they are promulgated. Thus, among the Jews there was the deification of slaughter, assumed to be the attribute of the God whom the people were bound to adore. With such an example, it should excite no wonder that the miserable fetish which at any time fanaticism can rear should engulf all patriotism or humane ideas. Of all the horrors with which man has cursed the world, foremost are *religious* wars. The darkest pages of history are those which depict the strife of creeds, always due to a selfish rapacity under the guise of the service of God:

> "God on the lip, but in the heart
> The gainful hope alone has part."

The history of theologies presents the curious fact that none of the religious reformers have left a written thesis of their faith, if Mohammed be excepted (he could neither read nor write) and if the Leke, or book of rites, be doubted, it is so with the moral teachings of Confucius. The preservation of his philosophy, then, is due to the memory of his followers. Five times his works were destroyed, but were restored by tradition.[1] Strictly, he was a moral reformer, and avoided all discussion on death or a future state; even on his death-bed, although repeatedly urged, he gave no decisive sign of his opinion; but, withal, the national mind adheres to him. How, when the transmission of the doctrines depends on traditions, are we to be assured we have the words, or even the sentiments of the reformers? We know that all enthusiasts amplify when they relate the acts of the founders of their faith or the tenets upon which their faith is founded; and the more they are absorbed in the doctrines they profess, the more they intensify their imaginings. All the creeds abound, viewing them as intellectual abstractions, with impossibilities, resulting in the substitution of the finity of the human mind for the infinitude of the primordial cause. The diversity of opinion shown in the various creedal expressions, should teach forbearance towards the beliefs of others, and when so-called inspired writings are in question the canon of criticism adopted should be applicable to all of them.

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[1] Clark, Bishop of Rhode Island, prior to his elevation to that dignity (1850), preached the following as the creed of the Christian faith. Speaking of the conditions of our future existence, he said, in substance: 1st. Provision will be made "for the culture and exercise of all intellectual and moral faculties. Heaven will not be a monotony. There will be full scope for development. Nothing we here learn will be lost," no elevated taste cultivated in vain, no healthy affection wither under the touch of death," &c., &c. 2nd. To the righteous the future will be a constant and unending progress, and will operate under greatly improved conditions. "We shall never reach a point where we shall stop and make no further advance; for there would then be an eternity before us without occupation." Finally, "Our future destiny will be in precise accordance to our deserts and characters: we shall reap what we have sown. We shall begin our life hereafter as we close it here. There is no such thing as separating the man from the character, and there is no such thing as separating the character from the destiny."

The mistake in theologies lies in ignoring the instincts or physical nature of man, and substituting an ordeal by which the natural is to be suppressed. They all start with the idea that death, disease, pain, and misery are the results of sin. Death is merely organic change, whilst disease and pain are the results of inherited and individual abuse of natural law; misery, the effects of conventional disparity or the neglect of social ordinances. To the theological reformer nature is vile, and all natural desires sin; salvation—the eternal good—only to be attained by a suppression of the impulses of sensation; hunger a weakness to be combated; maternal affection to be ignored; love a snare which hurls its indulgers into perdition, hence celibacy is enforced; to enjoy nature is to enter the region of everlasting death, and thereby the reality of nature is transformed into a purgatory of denial, making being but a foretaste of the fabled hell; inbreeding a habit to which no torture can come amiss. And through the system enjoined by strict theological rules we have the nun, the monk, the fakeer, the Buddhist devotee and Bonze—all examples of ecclesiastical rule, and all failures, or history has given a distorted picture. The religion of nature is the religion of perception and the use of natural gifts; the religion of the sentiment, conception, the merging the real in the ideal, intelligence into its ultimate. In this combination is found the true phase of religion, an appreciation of nature and her gifts, and a recognition of the spiritual merging in a supposed cognition of the unseen, an interweaving of the natural with the intellectual, culminating in the divine. Theology subverts nature and disregards her facts. Religion recognises the supremacy of nature in organized man, and in intellectual man discerns a reflex of the unseen, for it is through the homogeneity of the intelligence seen in nature that man conceives the being of God.[1] The impossible can never become the probable; by no intellectual effort can the attributes of Deity be depicted. It is possible to imagine what they are not, but this is far from knowing what they are. Every system of theology possesses the miraculous, and the evidences of thaumaturgy are analogous. If, then, the miraculous be the test of a system, how is discrimination to be made between the rival claims when the evidences each adduces are similar in character? The great difficulty is that the marvellous always developes into the incredible. The commencement is simplicity and truth; the pristine type becomes lowered, priestcraft enters; and the vulgar crowd heralds its own idolism. The Egyptian mob clamoured for their goddess Isis, and *the devout Cyril* developed the worship of "the mother of God" (*Gibbon*). The pageant becomes the power of the priest, and when political aspirations are ingrafted the power is cemented, the hierarch is evolved, the liberty of thought and conscience endangered, and persecution sustains the dominant faction.

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[1] Cambyses destroyed the statue of Memnon; Lepsius defaced many of the monuments by taking away their inscriptions for the museum at Berlin. The tradition among the Fellahs of Upper Egypt is that Lepsius destroyed the statue. Such is tradition! (*Beke's Memoirs of Sinai.*)

If an appeal be made to science the difficulty is increased, for God is "unthinkable;" unfathomable he may be, but the thought of God is the intellectual fact of the vast majority of cultured men, an idea always indefinite, yet always recurring, because the effort is always being made to make the indefinite the definite. According to science there is no God, for if He be a fact, the fact is inaccessible to reason, so, as a substitute Matter in its molecular aspect is presented. In "the potence of matter" are "all the forms and qualities of life." The potence of a thing is the possibility to become by its own inherent power. What is the potence of matter but the capability of being moved?—a something superadded to its mass. Forces act on matter; it has never been proved that matter generates the force which moves it. When the potence of intellect is spoken of, we face a something which, by an innate faculty, is capable of becoming—as the mind of a child or of a savage, by culture developes into intelligence. Matter has the capability of being moulded and changed; heap matter on matter we get but weight; a fact of gravity, in this matter has no part. Matter acted on by forces produces phenomena resulting in form; form is no product of matter. The motion of matter, if it exists, arises from the polarization of its particles. The polar fact is a condition of heat, an undulation of ultimate particles, or as it is termed vibration.[1] A picture is the effect of colours, but we cannot say there is a potence in colour to produce a picture; yet without colour there could be no picture. The capability of being moulded and developed and the capability to produce are logical, and fact distinctions. Matter thus becomes the objective presentment of a primordial principle; molecular energy (this panacea for our real ignorance of what are the real facts of motive power) is the action of a something by which motion is induced in the mass, thus motion is an effect; not a cause. This potence of matter is the basis of the materialistic faith, reduced into definite phases; we have a vibratory result realized in an unconscious insubstantiality; add intellect to colour and the picture is formed; add intellect to matter and we have Nature.

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[1] "We fan the imagination and labour to comprehend the immensity of creation, and fall back with the impression of the littleness of all belonging to us; our lives seem but a point of time compared with the astronomical and geological periods, and we ourselves as atoms driven about amid the unceasing changes of the material world." (*Brid. Treat.*, Bell, p. 228.)

Bence Jones says, "We are just ceasing to regard the nervous force as the origin of all power in the body. We have ceased to look on the human machine as the creator of vital force." It is obvious that vital force holds the organism together, and is the energy through which its motions are directed, therefore "the human machine" cannot create "the vital force." To regard the "nervous force" as the originator of all the forces in the body is simply to ignore the fact of vitality. We do not say the conduit is the originator of the water which flows in its cavity, or of the properties concentrated in the water. "The human machine" is an aggregate of dissimilar particles held in cohesion by vital action, the nervous system, is but the conducting wires by which the life energy is presented throughout "the human machine," for a nerve fibre may be compared to a bundle of wires, each having its battery connected with it."[1] Those who teach that the nervous force *originates* all the forces in the organism, and that "the human machine is *the creator* of vital force, sin equally against true induction, as those do who assert that the molecular changes in the brain produce consciousness and intellect. Science cannot account for the origin of matter, or say what or whence it is; then the attempt to account for life and mind as arising from a something—of the reality of which nothing is known—becomes a *reductio ad absurdum.*

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[1] "The doctrine of vibrations . . . is quite at variance with anatomy." "It requires, we should imagine, the existence of an ether, and that this fluid shall have laws unlike any other of which we have experience. It supposes a nervous fluid and tubes or fibres in the nerve to receive and convey these vibrations. It supposes everywhere *motion* as the sole means of propagating sensation." (Bell, '*Brid. T.*,' p. 176.) "Nor can I be satisfied with the statement that light and colours result from vibrations which vary from four hundred and fifty-eight millions to seven hundred and twenty-seven millions of millions in a second, when I find that a fine needle pricking the retina will produce brilliant light, and that the pressure of the finger on the ball of the eye will give rise to all the colours of the rainbow." (*Ib.* 177.)

"The disturbance of the extremity of a nerve, the vibrations upon it, or the image painted upon its surface, cannot be transmitted to the brain according to any physical laws that we are acquainted with. The impression on the nerve can have no resemblance to the ideas suggested to the mind. All we can say is—that the agitations of the nerves of the outward senses are the signals which the Author of Nature has made the means of correspondence with the realities." (Bell, '*B. T.*,' p. 172.)

Abstruse theories have been built on sensation, yet there is the widest difference of opinion concerning the changes which occur even when a simple nerve is put in motion[2]. Sterling says the sensationalists, "shut up in the mysticism of an unexplained and unintelligible chaos of sense, throw all into the unknown and dwell in a dogmatism, an obscuration and an intolerance peculiar to themselves." Snow tells us "Irritability involves sentience, sentience involves consciousness and self-consciousness, and these involve omniscience." If this be true, every organic irritation involves omniscience, when probably we are not sentient of its cause, or when it will cease, *ergo* irritation creates every possibility of knowledge![3] But this is scarcely more wonderful than, as we are told, "sheep is transubstantiated into man," or that "man is a sensible automaton."

Strauss says "that we must not ascribe one part of the function of our being to a physical, and the other to a spiritual cause, but all of them to one and the same, which may be viewed in either aspect." That there are physical and chemical phenomena consequent upon the vital principle, and that there are intellectual impulses in which the physico-chemical has no part, is apparent to everyone who thinks—the aspects are distinct. He appears to have satisfied himself "that no one who has a clear kosmical conception, in harmony *with the scientific facts* of the time, can, if he be honest and upright, believe in a personal God, and must confess that he is not a Christian." What is "a clear kosmical conception"? Can we be sure that any kosmical hypothesis is true, or so positively delineated that it is a fact of evidence? We know all substances are resolvable into gases, but we never see them subsisting as flaming elements. We find contact elicits heat, and sometimes combustion, resulting in changed forms. If the primordial or kosmic chaos, as pronounced, be an igneous vapour, whence was that we term matter? Whence were the forces we know permeate it? Whence was the life which renders it animate? Whence was the intellect which governs and fashions? We may indulge in kosmical hypotheses, but we are entirely without those evidences necessary to substantiate them as facts. How then, can there be "a clear kosmical conception" in "harmony with the scientific facts of the time," when in no system are there agreed data as to the primordial element, or its cause? There is no final science, so there can be no "clear kosmical conception." If there were, a man who had this "clear kosmical conception," could account for all origins and facts.

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[1] "The beauty and perfection of the system (nervous) is that each nerve is made susceptible to its peculiar impression only." "The nerve of vision is as insensible to touch as the nerve of touch is to light." (Bell, *Bri. Treat.*, p. 152, 153.)

[2] The senses of touch and hearing acquaint us with the mechanical impact and vibration of bodies; those of smell and taste seem to acquaint us with some of these chemical properties, while the senses of vision and of heat acquaint us with the existence of their peculiar fluids. ('*Zoonomia*,' vol. i, p. 69.)

Every gland of the body appears to be indued with a kind of taste by which it selects or forms each its peculiar fluid . . . . and by which it is initiated into activity. ('*Zoonomia*,' vol. i, p. 68.)

[3] "Our senses are not given us to discover the essences of things, but to acquaint us with the means of preserving our existence." ('*Malebranche*,' l. i, c. v.)

As high science, illustrative of the teaching of the time, we have:

> "Molecular energy determines the form which the solar energy will assume. In the one case this energy is so conditioned by its atomic machinery as to result in the formation of a cabbage; in another case it is so conditioned as to result in the form of an oak. So also as regards the union of the carbon and oxygen; the form of this union is determined by the molecular machinery through which the combining force acts; in the one case it may result in the formation of a man, in the other it may result in the formation of a grasshopper." (Heat, a '*Mode of Motion.*')

The molecular energy of earth substances controls the energy of the sun, producing a cabbage or an oak, a grasshopper or a man![1] Is argument needed? So we are informed. "the sun forms muscle and builds the brain," so, possibly, it does windmills and weathercocks. There is equal evidence for either proposition. Is it by such utterances we are to arrive at "a true kosmical conception?"

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[1] There is in the true man of science, a wish stronger than the wish to have his beliefs upheld, namely, the wish to have them true, which "causes him to reject the most plausible support if he has reason to suspect that it is vitiated by error" ('*Belfast Ad.*,' p. 56).

The sun may be the energizer of the world, for the motes in space—the suns and systems—are like nerve centres transfusing and transmitting the energy with which they are stored, and equalizing, by a recuperating power, the energy used in work. In this sense only can the sun be considered as the storehouse of energy (heat), centralized as to his system, and possibly the mediate factor, through magnetic action, of the changes we know in phenomena, but to other systems he is relative as a part of the great astral cycle. By the necessity of the molecular theory heat is transfused into motion, hence heat is known as vibration. If the suns of the universe have flaming photospheres, or even if that we deem ignited gas is only a magnetic action, then heat is the motor principle, spread as a jelly-like stuff from the centre to the circumference of the universe. These suns and systems are but the active workers, the way-houses of transmission, by which the slightest particle is governed, and the zones of suns made to oscillate in unison. Whether heat be a principle or the merest vibration, it is the pulsation from the great core where the afferent and efferent streams of force mingle.[1] What the brain is to the nervous system, the great central nucleus is to the universe. Heat, in an active or passive form, pervades it; where space is, heat is. To the presence of heat we owe all objective manifestations. As to wasted heat and degraded energy, the phrases should be erased. Tolver Preston, with reason, says:

> "The conclusion would seem warranted and necessary that work . . . must take place widely in nature, and thus part of the store of energy accumulated in materials on the earth's surface by the sun is made to fulfil a useful end, instead of being uselessly dissipated in space." ('*Nature*,' v. 17, p. 204.)

Huxley, also, in his masterly address, delivered before the Geological Society (1869), demolished the theory of Thomson and Tait based on the degradation of energy hypothesis. Strauss asks: "Who, &c., can represent to himself a deity enthroned in heaven?" Has not the ancient personal God "been dispossessed of his habitation," "by the revelations of physical science?" Heaven is a conventional phrase. Heaven would be everywhere, if man would permit. The heaven of the kosmos may nevertheless exist as the centralizing power. The heaven of Confucius was comprehensive as his idea of God. Whatever may be the denials of an unhesitating materialism as to the existence of the cause, to reason, it is apparent. Haeckel admits a cause, however he qualifies it. But with all these denials, law is admitted. And what is the law but that concentration of an energy intellectually directed which makes the homogeneity of nature possible? We are told all things are the consequences of law, but that law is a material consequent; it is very like saying the law makes the thing, and then the thing makes the law.

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[1] Sensation and volition are movements of the sensorium in contrary directions. Volition begins at the central parts, and proceeds to the extremities, and sensation begins at the extremities and proceeds to the central parts ('*Zoonomia*,' vol. i, p. 71).

Hume says causation is an invariable antecedence, *i.e.* "we call that a cause which invariably precedes; that an effect which invariably succeeds."[1] An effect is not always the result of a preceding effect, as day and night proceeding from a cause not apparent, the rotation of the earth. We trace effects backwards until we find no preceding mechanical or chemical effect. This we name the cause. Cause and force arrived at, force becomes the acting fact of the cause; electricity, magnetism, &c., we know as working powers in nature.[2] The primordial force of phenomena is heat; this accepted, all forces would proceed as conditions of the primal force. No motion ensues without heat being evolved, but no motion can ensue unless heat (static or dynamic) be existing. When bars of antimony and bismuth are in contact, an electric action results; unite the extremities by a fine platinum wire, and it glows with heat. This shows that the heat latent in the bars has become active. Heat and electricity are correlated—possibly the same force exhibited in different aspects, the *cause* of which will probably remain a secret. As a principle, heat is universal: we cannot say the same of electricity, unless it be affirmed that polarization is a resulting fact of electricity, for all substances in their particles are said to be polar. When we meet with the universal as a motor fact, it is a power in nature. Grove has established the correlation of "heat, light, electricity, magnetism, chemical affinity, and motion." Before the display of any of these effects, heat must be existing as a specific power, although imponderable. If, then, it be specific, it exists as a principle; all forms of power then become conditions of heat, *i.e.* methods through which it acts (*vide supra*, note 3, p. 5.)

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[1] Conventionally, cause is succeeded by effects, and all effects preceded by a cause. Science talks of the precession of causes, of factors and facts. In rigid reason effects succeed effects in endless successions, springing from one essential cause. In the things of our knowledge, the sequent has its antecedent, and each antecedent springs from an effect. We trace the line backward until we pause, finding it impossible in reason to go beyond an origination, to which there appears to be no antecedent. Call it what we may, Cause, Creator, God, we arrive at a fact which, perforce, we name the uncaused cause; thus we arrive at a succession of effects originating from that of which we can conceive no beyond—in itself capable and concentering in itself all effects, because they result from a single impulse.

[2] "I have long held an opinion almost amounting to conviction, in common, I believe, with other lovers of natural knowledge, that the various forms under which the forces of matter are made manifest have one common origin, or, in other words, are so directly related and mutually dependent that they are convertible, as it were, one into another, and possess equivaleuce of power in their action" (Faraday). Grove has verified the idea.

It is idle to discuss the personality of God, no evidences can be adduced on which such a fact could be founded. Whatever be the controlling fact of nature, it is centralized, hence individualized. The onward induction does not appear difficult. By dissecting phenomena we find control and infinite knowledge; *if knowledge be required to systematically pull to pieces, surely a greater knowledge would be required to construct*, and this constructive fact general consent terms omniscience. The admission of omniscience in its unity is very like the admission of a personification, for the halt cannot he made in the exemplification of a mere creative power; there must also be a maintaining power.[1]

Strauss avowed his materialism, an honester procedure than leading to the same conclusions by ensnaring subtleties. Allusions may be made to "our noble Bible" and a lecture abound in scriptural allusions which, according to the bias of the lecturer, may be irony or faith, and an eulogy be written on the Bible which might gracefully come from the pen of a theologian, but all this in no way alters the tendency of the teaching: thinkers judge by the written and spoken themes. Huxley objected to Stirling's critique on "the physical basis of life." Of the relevance of his answer each can judge (*vide Yeast*); but when he concludes by saying—"one great object of my essay was to show that what is called materialism has no sound philosophical basis," there seems somehow to be a confusion of ideas. There can be no doubt that the tendency of the scientific teaching of the time is to relegate all phenomena to matter as the creative fact, and if a cause be intruded, it is so inappreciable in quantity—of quality there is none—that it becomes *but a waiting purpose* of which *no* estimate is to be taken. Strauss says, "The comprehensive Kosmos," or all "is the sum total of infinite worlds in all stages of growth and decay" and eternally unchanged as regards "the constancy of absolute energy amid the everlasting revolution of the mutation of things." Despite all the pronounced and authoritative dogmas—with all their unthinkables, unfathomables, and impossibles—man intellectually seeks for, thinks for, and endeavours by a mental analysis, or by an intellectual synthesis, to account satisfactorily, at least to himself, for the cause of the effect. Hume says "The whole frame of nature bespeaks an intelligent author" (*Introd. Nat. Hist. Rel.*)

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[1] The oneness of facts is the "bearing of one part upon another (whereby) we receive an impression of adaptation, of mutual fitness, of conspiring means, of preparation, of purpose and provision."—*Whewell, B. T.*, p. 13.

Theologians present God as the cause or creative fact; had they paused there, the position would have been unassailable, but ultra propositions have weakened the position. Whilst the general fact is probably incontrovertible, the adjuncts must be shattered in conflict. It is impossible to define the nature of the causal being, or God. We may think it, feel it, believe it, but cannot know it!

Strauss rejects the idea of spontaneous generation, and says it is only necessary "that matter and force already in existence should be brought into another kind of motion and combination" to produce the effects. What then would the bursting forth of life be but spontaneous generation? The Bathybius was presented to the admiration of the learned as the causative fact of life, and excited a storm of adverse criticisms. At the bottom of the Atlantic ocean was discovered a slime, "due to innumerable lumps of transparent gelatinous substances," "each lump consisting of *granules*, *cocoliths*, and foreign bodies, embedded in a translucent, colourless, structureless matrix." "The granule heaps and the transparent gelatinous matter in which they are embedded represent masses of protoplasm." One of these masses (*urschleim*) is to be regarded as a new form of the simplest animated being, proposed as the "*Bathybius*," a relation being found to this *protoplasm* in the spicula of sponges. The Bathybius, "a vast sheet of *living matter* enveloping the *whole earth* beneath the seas," and then a picture is formed of a new flora and fauna which will require thousands of years to bring to completion ('*Microscopic Journ.*,' October, 1868). Wallich on its introduction pronounced the Bathybius to be a myth; it was a grand conception, but formed on insufficient data. The Challenger expedition showed instead of this stuff being spread over the bottoms of the oceans of the world, it occurs in comparatively few localities, and is not "a widely extended sheet of living protoplasm which grows at the expense of inorganic elements." Experiment has proved it to be an inorganic compound of sulphuric acid and lime. The whole imaginative machinery and its error arose from some masses of this stuff preserved in alcohol being sent to Huxley, on which he experimented. The dissipation of the dream was reserved for the naturalists of the Challenger expedition. Murray says "In the early part of the cruise many attempts were made to detect the presence of free protoplasm in or on the bottoms from our soundings and dredgings, with no definite result." It was undoubted however, that some specimens of the sea-bottom preserved in spirit, assumed a very mobile or jelly-like aspect, and also 'that flocculent matter was often present.' This mucus-like mass *wanted motion*. On analysis Buchanan found it to be sulphate of lime presenting an amorphous precipitate on the addition of spirits of wine;—when dissolved in water, and allowed to evaporate, it crystalized into gypsum. The crystals were all alike and no amorphous matter was found. The treatment by spirit created the whole difficulty."

Strauss hailed the discovery as perfecting his hypothesis. He says:

> "The existence of this crudest form has since been actually demonstrated. Huxley has discovered the Bathybius, a slimy heap of jelly on the sea bottom; Haeckel has what he has called the structureless clots of albuminous carbon, which although inorganic in their constitution, yet are capable of nutrition and accretion. By these the chasm may be said to be bridged, and the transition effected from the inorganic to the organic."

Darwin is called by Strauss as a witness for his kosmic conception, but Darwin affords no such evidence; he distinctly admits a Creator. Strauss also speaks of

> "The magic formula, by which science solves the mystery of the universe. 'Every mystery,' he says, 'appears absurd,' and yet continues, 'Nothing profound, whether in life, in the arts, or in state, is devoid of mystery.'"

The phenomena of life and structure do not appear to have been studied by him. The wonder is, not that he was wrong in his conclusions, but that others, well acquainted with organic structure and life, should inculcate analogous systems. Mechanics cannot account for the living protamœba; there is no mechanical apparatus which by an inherent faculty can grow or multiply itself. The living machine does both.[1]

The advantage of *religious* faith in the satisfaction it gives to the intellect "by fixing it on invisible ends and ties, rendering life something more than it seems to be, can hardly be exaggerated." A world of mere phenomena in the superficiality of scientific deductions, might become a greater danger to "society than even those stronger . . . . passions . . . . of which there is such wholesome fear, and which, it is justly said, only a deep religious faith can adequately restrain." In a world without faith there would be that "passionless ennui" which forces the enquiry is "life worth living for?" To some minds materialism may prove satisfactory. In all its schemes there is the *quasi* admission of the cause. The admission, however qualified, is the thin end of the wedge which topples the structure into ruins. If religion be grounded even on superstitions, it has its satisfaction in the exigency of the fact; but where in the material hypothesis is to be found such satisfaction?

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[1] Where in physical force are we to find the discrimination of the vital force? where the immensity of variation, the infinity of adaptation? Where in physical force are we to find in apparent weakness the greater strength?

In England Huxley and Tyndall have, in the popular conception, the foremost place as the exponents of scientific opinion. In their particular studies both have attained eminence; but their supremacy is gone when they stray beyond the technics of their sciences. Both are advocates of material views. Huxley, a giant in his science, attempts an explanation, but appears to give too large a view to what he terms "*states* of consciousness." When he says impenetrability, extension, and resistance are states of consciousness, we then enquire what consciousness means, and find it to be an instantaneous impression or the experience of a sensation, both are passive results; neither resistance nor extension are such passive results: we know them through mental action, therefore they are not *per se* facts of consciousness, but facts of intelligence. John Stuart Mill (*Essays on Religion*) makes conscience and consciousness the same. In the vagueness of the phrase, "states of consciousness," notwithstanding deductions from Kant, the definition becomes a confused riddle.

In his lecture on "Descartes' discourse on method," he (Huxley) continues:

> "I am prepared to go with the materialist wherever the true pursuit of the path of Descartes may lead." ("But this path," he tells us, "leads two ways—by that of De la Mettrie and Priestley to modern physiology and modern materialism; and by that of Berkeley and Hume to Kant and idealism—and that "each branch is sound and healthy, and has as much life and vigour as the other.") "And I am glad . . . to declare my belief that their fearless development of the material aspect of these matters has had an immense influence upon physiology and psychology. Nay, more, when they go further than I think they are entitled to do, when they introduce Calvinism into science and declare that man is nothing but a machine, I do not see any particular harm in their doctrines so long as they admit, which is a matter of experimental fact, namely, that it is a machine capable of adjusting itself within certain limits." "But when the materialists stray beyond the borders of their path and begin to talk of there being nothing else in the universe but matter and force and necessary laws, I decline to follow them. I go back to the path from which we started, and to the other path of Descartes." We have seen "in a manner, which admits no doubt, that all our knowledge is a knowledge of states of consciousness. Matter and force, so far as we can know, are mere names for certain forms of consciousness. Necessary, means that of which we cannot conceive the contrary; law, means a rule which is always found to hold good. Thus it is an indisputable truth that what we call the material world is only known to us under the forms of the ideal world; and, as Descartes tells us, our knowledge of the soul is more intimate than the knowledge of our body. If I say impenetrability is a property of matter, all that I can really mean is that the consciousness I call extension, and the con-

> sciousness I call resistance, constantly accompany one another. Why and how they are related is a mystery, and if I say thought is a property of matter, all that I can mean is that the consciousness I call extension and that of resistance accompany all other sorts of consciousness. But as in the former case why they are thus associated is an insoluble mystery. From all this it follows that what I may term legitimate materialism, *i.e.* the extension of the conception and of the methods of physical science, to the highest as well as to the lowest phenomena of vitality, is neither more nor less than a short-hand idealism, and Descartes' two paths meet on the summit of the mountain, though they set out on opposite sides."

We have subtlety on subtlety through the whole of the dissertation; from all that appears, the path by De la Mettrie and Priestley is the broad beaten way; whilst that by the way of Berkeley and Hume, presents an occasional illusion.

If the "subtle Berkeley" stepped "beyond the limits of knowledge, when he declared the substance of matter did not exist," what do those who see in matter "all the forms and qualities of life," and in molecular vibration, heat, consciousness, life, and intellect? Brute matter, as Hume expresses it, the cause, the effect, the creator, the thinker, the feeler, and this matter made up of inert indurate atoms, of the dimensions $\frac{1}{300,000,000}$th of of a line, an inch in extent. Yet science is stated to be the result of *perception* and *experiment*! Berkeley denied matter existed, except as it existed in consciousness. Yet his system is *consistently* decried by those who argue that the qualities of things are but states of consciousness. If we listen to commentators, the systems of Kant and Spinoza, like that of Darwin, mean only that which suits their views. Both Kant and Spinoza, construed in the spirit of their intention, pourtray the pre-eminence of Deity. Darwin attempts to show the mode by which the constructive faculty of the Creator works. The first has a kosmic theory, but in intelligence idealised finds his pre-eminent ALL. Spinoza sees God even in matter, yet spiritualizes all in his ideal of GOD; and Darwin, whilst presenting his view of the constructive energy of organic life, acknowledged all was the work of the Creator. Descartes combines Kant, Spinoza, and Darwin, and, be his method whatever it may, he had a firm conviction of the existence of God as the Creator, and antecedent of all things.

Consciousness, to the mind and sensation, is what the retina is to the eye, a medium on which the symbol is instantaneously impressed (Helmholtz measured an interval), which symbol, when interpreted by intelligence, becomes a reality; thus intelligence counts for all in the Great Kosmos by which we are surrounded. No thinking mind will doubt that mechanico-chemistry is the modus through which the kosmos is presented and is construed;

but this is different from saying mechanics and chemistry initiated the Kosmos. If they be the creations of intellect, as undoubtedly they are, they become, as the constructors of material forms, the agents of intelligence. Where are we to find the logic which makes resulting effects institutors of that of which they are the result? If phenomena be regarded as a form of intelligence, we can have at the same time intellectual probabilities, ideal possibilities, with mechanics and chemistry as constructive elements; but never as creators. It is possible to understand a chain of effects resulting from a single cause, but it is impossible to conceive a cause being the result of the effect it had instituted. The method of the world must include intelligence, for there could be no mechanics without it; the only conclusion to be arrived at, is that creation is the fact of intelligence. Vitality, as a principle, being the primordial of nature, makes the axiom *omne vivum ex ovo* true of the beginning of life, and its changes to *omne vivum ex vivo* true of all the after facts of life. The life first proceeds from the the egg or jelly-speck, and the living organism reproduces it, and thus the apparent contradiction is satisfied, the living organism proceeds from the egg and the egg from the living organism, *i.e.*, the initiatory fact is always continuing.

Chemistry and mechanics, as we know them, are supposed to be the invention of man, when in fact, they are processes by which nature compasses her designs. If it required intellect to disinter them from formulated matter, in order to apply them to the uses of man, surely it required intellect to institute them.[1] If, then, intelligence instituted matter and its forms—for forms are all we really recognise in objective phenomena—to form is due the multitudinous variety we know as Nature.[2] Have we not, then, in this exposition, the single factor and the single equation by which, according to Nägeli, we can only correctly construe all that we find within and around us? a factor fitted for all the purposes of production, and an equation filling the purposes of its detail. We call the motion apparent in matter, force, because we so name a moving power. When we talk of an unperceived motion occurring in the inner recesses of a living substance, if it be force, it is inherent, the power of the formed particle. It may be called molecular, or vital, or polar, call it what we may, it means the interior power in the particled mass, acting through itself, without initiation, but by the inherent fact of its own existence, and may be said to be *the nerve power of the Creator vibrating through the mass.* Matter is but an aggregation of particles forming a mass. Intellect is perfect in every particle, and by culture assumes its magnitude. A single particle of intellect is an idea, an idea produces an idea, but no aggregation of intellectual particles can produce more than an idea. If then, matter can only be perfected by a summation of particled aggregates, and intellect is perfected in its particle, what shall we say?—that intellect arose from matter, or that matter is the result of intellect, constituted through appointed motors? If intellect construes itself, we have then a knowledge only limited by the powers of intellect, and a probable verification of Nägeli's problem; but if we deduce intellect from matter, we have the axiom of Du Bois Reymond and its pertinacious consequence, "*Ignoramus ignorabimus.*" A thing can be no more than a product of its particles. Intellect, perfect in its particle, is only equal to itself in all its forms. Matter in its particle, being "*insignificant*" (*vide* Nägeli), cannot be more than form, whatever its importance in the economy of nature.

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[1] Man "can establish no new law of nature which is not a result of existing ones He can invest matter with no new properties which are not modifications of its present attributes. His greatest advances in skill and power are made when he calls to his aid forces which before existed unemployed, or when he discovers so much of the habits of some elements as to be able to bend them to his purpose" (*Whewell*, '*Bridg. Treat.*,' 359).

[2] "The laws of nature . . . are the rules for that which *things* are to do and suffer; and this by no consciousness or will of theirs. They are rules describing the mode in which things *do* act." "The metaphor is very simple, but it is proper for us to recollect it as a metaphor, in order that we may clearly apprehend what is implied in speaking of the laws of nature" (*ibid*, pp. 6, 7).

Naturalists are puzzled to define the vital principle. Physico-materialists affirm life is a property of matter, and deny the spontaneity of life. Spontaneous life, as originating in matter, cannot be upheld, for nature exists through vital action. How the inert and evanescent can be the existing and real has never been proved. Despite Belfast orations and boiled substances,[1] nature holds on her way by an existing and uncontrollable principle, through a vital spontaneity, awaiting conditions which when satisfied, life bursts into being. Every evidence shows this is the fact

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[1] If it were wished to prove the power of an intricate mechanism depending on a little wheel (*even although "a capricious" God direct it*), we should not take away the little wheel and then expect the machine to work. Yet this is precisely what is done by those *who boil infusions* and *exclude them from the air*. It is like expecting the machine to work when all conditions of action are destroyed. Contact with the air produces the conditions necessary for the exhibition of life. There may be germs or minute coagulations which require contact to perfect their conditions, and present them as vehicles of life. What is this but the first blushing of life? If organisms are progressively developed, spontaneity of life in the lowest stage must be its first and its only result; all else becomes development. Before the theory of evolution was practically applied to the things of life, spontaneity was scientifically impossible. The theory recognised, spontaneity is its only reasonable outcome. Life from the germ is as old as the oldest recorded thoughts of the Egyptians. Who can say how long before them it existed?

of phenomena: in the inorganic, expressed as the polar fact; in animate forms breathing and reproduction, with a power to change position; in plants breathing and reproduction. In living forms there is an ingeneration in an ingeneration, and if vitality be the persistent fact, then the inorganic must be capable of its presentment. The gaseous, moulded by vital power, presents the diversities of phenomena. By collection and condensation we have *the vehicle of life, but not the life.* The protoplasmic substances might be for ever exhibited, and yet there be no presentment of life. What the particular modifying conditions are by which the inorganic becomes the organic, or how the inanimate substance becomes animate, is a secret not solved. We have the carriage of life, we are able to dissect its parts, to note its changes, and to form some of its constituents, but the mystery of the albumen and of the vital fact defies analysis. In the ice cavern life is rarely engendered. Heat is incorporated before the life is displayed, and if heat be the primordial element, an atom does not exist because it is resolved into its primary. Steam issuing from an aperture under pressure is imperceivable; on the temperature being lowered, we have the cloud or heat dust,[1] condensing into the fluid and solid. If there be law, it must be universal in its operation; then exactly what we know as a condensation of heat occurs in all substances. The conditions alone are varied; we have the imperception, the cloud, the liquid, the solid. A pertinence is added to the argument now oxygen, air, and nitrogen have been condensed, and hydrogen presented in metallic drops.[2] In nature the paraphernalia for the conversion exists, the cold of space and the pressure of atmospheres. If Cooke's calculation ('*New Chemistry*') as to the enormity of weight involved by the undulatory theory of light be true, we have a pressure more enormous than any human ingenuity could supply. Heat as the primary must remain as an hypothesis; but natural facts point to it as the true agent of nature as a principle, the undulation being a condition. When heat is combined with vital action, it becomes the factor of material phenomena. The life controls the substance, but without the substance there is no manifestation of life, without the life there is no manifestation of intellect. We cannot say that life is heat, nor that heat, as a substance, is life, or that life is intellect. As abstractions, we have three all-pervading principles, heat, life, intellect, as the sum of all we perceive, or conceive, think, or feel, translated by consciousness. Consciousness we cannot say is a principle, although, a necessity of life, passively capable of instantaneous impression; it reflects images, feelings, and thought; an incident of life, not a vital fact, for life can be when consciousness has ceased. Lewes tells us, "the universe exists, but does not live." The universe is an organization direct~~ing~~ and possessing functions; the distinction between life ed and existence is found in the active or passive fact. Vitality subsists in the universe, and the universe exists in its vitality.

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[1] Tyndall's water dust finds a parallel in Whewell's *fine watery powder* (*Brid. T.*).

[2] Andrews, of Belfast, by experiment arrived at the conclusion that the gaseous and the liquid are but "extreme stages of one and the same condition of matter." He failed to liquefy either oxygen, hydrogen, or nitrogen. Cailletet, in September (1877), rendered acetylene (hydrogen and carbon) into a liquid; on Novamber 27, nitric acid (hydrogen and nitrogen). He then succeeded in liquefying oxygen and carbonic oxide by pressure and freezing. The pressure he obtained by means of hydraulic power, 4400 lbs. to the square inch, the temperature at the same time being reduced by freezing mixtures. On releasing the gas from the pressure, its expansion reduced the temperature to 200° below zero Cent.; the partial liquefaction was shown as a dense cloud. Before he had made his discovery public, Pictet, of Geneva, succeeded in liquefying oxygen; he obtained not a cloud, but a jet of liquid. The results were independently obtained. Pictet's results were obtained through an elaborate machinery, the efficiency of which depended on the rapid evaporation of volatile liquids, as liquid sulphuric acid (the condensed anhydride), and by a pressure of 500 atmospheres, eventually falling to 350. The gas subjected to experiment was generated in a strong iron vessel, and thence conducted into a strong long glass tube immersed in a larger tube containing solid (frozen) carbonic acid An orifice closed by a screw tap put the oxygen in relation with the atmosphere. On turning the tap the pent gas shot forth in liquid jets. By means of the electric light, the jet was shown to consist of two parts, an outer blue cone of condensed

Atoms and molecules, Huxley tells us, are *but imaginative* symbols, and that he who mistook them for real quantities would err equally with the metaphysician who should so mistake his *x*'s and *y*'s. Whether they be facts due to "scientific imagination," or what, by him they appear to be treated as real quantities, for now-a-days the molecular theory is the expositor of every difficulty, not alone in the inanimate, but in animate forms; it has possession of the brain; molecular motion produces intellect! Tyndall talks of the thinking brain as of a something more than an organ. People talk of a musical box not *as creating* the sound, but as the vehicle for its expression. The brain, notwithstanding what physicists say, never created the intellect.[1] It, like the

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gas and an inner white portion, in which the oxygen exists in a liquid and probably, as suggested, in a solid condition. Cailletet released nitrogen from a pressure of 200 atmospheres, when, on its eruption, the temperature became so lowered that drops of liquid nitrogen were formed. On the last day of 1877 he succeeded in liquefying air. Pictet (11 Jan., 1878) succeeded in producing hydrogen in a solid form by a pressure of 650 atmospheres. On opening the stop-cock, the hydrogen shot forth in a jet of blue-steel colour, the solidified drops falling on the floor with the ring of metallic grains, leaving little doubt that hydrogen is the vapour of a metal. Water thus becomes a metallic oxide. Dumas' idea.

Perkins, of the Royal Society, in 1823, claimed to have liquefied atmospheric air under a pressure of 1100 atmospheres.

[1] In quadrupeds the brain is fully developed at the birth, *i.e.* all the parts are as

musical box, is the vehicle of expression.[1] It is impossible to understand a motion of molecules without a motion of neighbouring molecules. Huxley says :

> "'The mental states we call sensations and ideas are caused by modes of motion in the brain, and the mental causality of volitional and emotional movements really originate in certain movements of the brain, of which those mental states are merely concomitants.' The feeling we call volition is not the cause of the voluntary act, 'but the symbol of the state of the brain is the immediate cause of the act.'"[2]

There is evidence that the brain is the organ of the nervous functions, but the assertion that the brain originates consciousness is the merest conjecture.[3] The spider, the ant, the bee,

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perfect as in an adult animal of the same species ('Wentzell,' p. 246). In man, the brain makes continual progress to its ultimate magnitude and perfect state from conception to the seventh year after birth. Those parts which are formed subsequently to birth are those parts entirely wanting in lower animals, and as the parts are developed peculiar faculties are proportionally developed; but until this development those faculties are not clearly perceptible. From the age of seven to that of eighty the changes respecting size, collectively or in parts, are so trifling as to be unworthy of notice ('*B. T.*,' p. 247, 286, Bell). Combe's opinion was the human brain increases in size until twenty-eight years; some assert the increase continues on until forty years of age. It is observable "the adult human being as much excels in design and method the actions and operations of all other adult animals, as those of the infant are excelled in precision and adroitness by the young of all other animals ('*B. T.*,' *ib.* 247), corresponding with the relative constitutions of brain at the respective periods."

[1] At a *séance* at the Academy (1876), MM. Giacomini and Mosso showed the photograph of a woman who had lost a great part of the frontal and the two parietal bones through *syphilis*. She is now cured. The movements of this brain were studied by one of M. Marey's tambours being applied to the cranial aperture. It was proved there are in the brain of man, even during the most absolute repose, three different kinds of movement. *Pulsations*, which are produced at each contraction of the heart. *Oscillations*, which correspond to the movements of the respiration. *Undulations*, which are the largest curves, and are due to the movements of the vessels during attention, cerebral activity, sleep, and other causes unknown; they might be called *spontaneous* movements of the vessels ('*Nature*,' vol. xv. p. 264). Other interesting particulars are narrated. All tend to show that the brain is a mere functional organ impressed by causes external to itself—not creating and originating—so far as function is concerned, any other part of the body might as well be the thinking fact, as the "thinking brain." It is probably the organ through which thought is manifested, as the musical box is an organ by which sounds are displayed, but the sounds depend on an impulsion. In the box, mechanical force; in the brain—what?

[2] Erasmus Darwin has a somewhat similar expression, but he refers all to the spirit of animation and vitality; and yet by a peculiar perplexity makes motion and other acts of the organism due to the excitation of pleasure and pain; not as Bain has it, "pleasure in the distance and pain in the distance," but as the causes of immediate irritations to which by a series of augmentations, accumulative in character, he imputes the health or disease of the organism (vide '*Zoonomia*').

[3] "The similarity of the texture of the brain to that of the pancreas" has led to the supposition "that a fluid perhaps more subtle than the electric aura is separated from the blood by that organ for the purposes of motion and sensation . . . the electric fluid is actually accumulated and given out voluntarily by the torpedo and *Gymnotus electricus*, and an electric shock frequently stimulates a paralytic limb and

&c.[1]—to judge by effects—think, invent, and construct; but where in the invertebrata is found that complicated substance we term the brain? If the hypothesis be true in one relation, it must be true in all its bearings; and unless all animated things doing intelligent acts have this substance, how are we to say that the powers manifested by them are due to the molecular changes in the brain? The answer may be that there is a microscopic substance which serves this purpose, and then the enquirer would be crushed down by a jargon of scientific presentments, as gangliæ, &c. When we speak of the animal brain, we have pulp substances of two characters, for which, in the invertebrata we look in vain. By the convoluted surfaces, according to Gall and Spurzheim, the intellectual intensity is induced. In the inspection of the nettle-sting the microscope discloses a fluid in motion. Goodsir found the same motion in a minute fungus from the eye of a gold fish; spores were extruded, which swam about like animals. The same action was detected by Haeckel in a minute alga. The nettle-sting may be filled with a fluid protoplasm, as doubtless were the fungus and alga. It is probable the insect nerves have a similar fluid, if not a fluid, then a substance capable of conveying sensory and will action, probably by some power analogous to electricity or magnetism, but the conductors of the electric and magnetic fluids no more account for the presence of the fluid than does the brain for the intellectual manifestation. In another place Huxley says:

> "That the phenomena of life are dependent neither on physical nor chemical, but on vital force, yet they result in all sorts of physical and chemical changes which can only be judged by their own laws. ('L. S.,' p. 92.)

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needs no perceptible tube to convey it . . . The singular figure of the brain and nervous system seems well adapted to distribute it over every part of the body." ('*Zoonomia*,' vol. i. p. 9).

[1] Evelyn, describing the actions of a spider (*Aranea scenica*), "Did the fly happen not to be within leap, the spider would move towards it so softly that its motion seemed not more perceptible than that of the shadow of the gnomen of a dial; if the intended prey moved the spider would keep pace with it exactly as if it were actuated by one spirit, moving backwards, forwards, or on each side, without turning, When the fly took wing and pitched itself behind the huntress, she turned round with the swiftness of thought and always kept her head towards it though to all appearance as immovable as one of the nails of the wood on which was her station, till at last being arrived within due distance, swift as lightning she made the fatal leap and secured her prey." A parallel we find in a wasp hunting a spider. "The spider as soon as he found himself marked down showed the greatest terror, running hither and thither, with many doubles and turns . . . these the wasp followed accurately turn by turn, never quitting the spider's track . . . recovering when at fault like a dog, until after an exciting chase he seized his exhausted prey" ('*Nat.*,' vol. xvii, p. 381. It is suggested the trail is afforded by web left on the spider's track. This idea is repudiated by the original correspondent and on sufficient reasons (*ib.*, p. 418). *Vide* explanation by C. L. W. Merlin ('*Nat.*,' vol. xviii, p. 311).

Imagination may breed imagination, but none the more is it proved that the material compound we call the brain by an imaginative or a real motion *breeds* the intelligence. If intelligence be induced by material changes, where is the pertinence of the quotation Huxley adopts from Emerson. "Truly it has been said to a clear eye the smallest fact is a window through which the infinite can be seen" ('L. S.,' 104). If all be matter, or of matter, there can be no Infinite. The meaning becomes clearer when we read—

> "I hold with the materialist that the human body, like all living bodies, is a machine, the operations of which, sooner or later, will be explained on mechanical principles." "I believe we shall arrive at a mechanical equivalent of consciousness as we have arrived at a mechanical equivalent of heat," and "that thought is as much a function of matter as heat is." ('*Macmillan's Mag.*,' xxii, p. 79.)

When it is really known what heat is, it will be time to say its equivalent is found; but we have not arrived at an equivalent of heat even as we know it. The equivalent suggested, the foot pounds, is but a question of temperature or of work; all force facts, more or less, are heat facts. The heat fact, either as a principle or in its conditions, is universal. An expression of capacity differs greatly from an expression of equivalence, and no foot pounds could be presented as the equivalent of universal power. We might just as well say there are so many particles in a cubic foot; the universe is composed of so many cubic feet, and the particle thus becomes the equivalent of the whole; either would show a measure of quantity, but it would be difficult to change a measure of quantity into an equivalence of its working fact. With more reason it could be said a looking-glass was the mechanical equivalent of consciousness, but to get a real equivalent for a passive fact appears to be an impossibility. There is no working power in consciousness, it merely notes received impressions; unless we mix in one heterogeneous heap, sensation, mind, life, intellect, conscience, and consciousness, we have in it a mere passive implement. We might just as well take Thomson's infinitessimally small and imperceptible masses of matter as the equivalent of matter, or say with Hartley, that touch is the equivalent of the senses, or that the vibriunticules are the equivalents of sensation and vital motion. When all is said, we can only say the multiple of a particle is the expression of the mass; we can no more say a particle is the equivalent of a whole than we can say the infinitessimal portion of a grain is the equivalent of gravitation.[1] No authority can make the inexact the exact. The fall of a pound 772 feet, raising the temperature 1°, the foot pounds is but the mechanical expression of force exhibited as work; force is as much an objective thing as matter, for both probably are expressions of heat, latent or active. We can add particle to particle and make a sum of the whole, but no additions of temperature will make a sum of heat; we merely arrive at an equalisation.

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[1] Gravitation is an accepted fact of science, but as explained by science, its ultimate fact is weight. A reasoning on ultimates finds as a definition a pressure on, or

In his lecture on biology, Huxley expresses great disgust at what he calls "paper philosophy." What is his dissertation, "the physical basis of life" in the main, but paper philosophy? Where are we to find an experimental proof for his deductions? We have an aggregation of chemical elements, but there is no warrant for the assumption that they constitute the "physical basis of life" in the sense of creating the life. That, where life is found these elements are found is one thing, but to say they create the life is quite another. Virchow (*infra*) has shown us what science should be, and should do, and with a masterly hand has drawn the distinction between dogmatic assumption, and fact, and has shown

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a crowding to the centre. Were gravitation the primordial fact, there could be no phenomena; it is to the combating of this *passive* energy we owe *that* we know as nature. The objective world is comprised of minute particles; these particles possess the polar fact. On consolidation, they are things with two ends or poles, attraction at one pole repulsion at the other; hence a power within the thing (particle, atom, or molecule, as a symbol, the phrase is indifferent). When repulsion is in the ascendant the passive fact of gravitation disappears, and that we knew as gravitation reappears by transference into an active form of force by the principle of correlation, If we have hydrogen gas in an open vessel we turn the mouth downwards if we wish to keep it there, otherwise it would pass into the atmosphere and thence into space and be lost to us; but here it is arrested by the gravitative correlation of affinity, and by combination with another substance, subserves again the uses of nature. If, on the contrary, we have oxygen in the vase, we turn the mouth upwards because if reversed the vase would be emptied by the gravitating fact of weight. The oxygen being heavier than the atmosphere keeps its place in the vessel. We have two substances, one amenable to the law of gravity expressed as weight, the other wholly free. Can we then say the gravitating fact is universal? The universal alone is the true, hence we say gravitation is only universal by being amenable to the principle of interchanging forces (correlation), hence gravitation becomes correlated. Gravity in its correlated fact becomes repulsion; in its double aspect, attraction and repulsion, polar. We have then the force rushing in the straight line, which would be interminable but for the pull to the centre, hence the curve which unites the two ends of the line. The same polar fact presented in the particle is equally active in suns and planets, and to go further, systems of suns, as representing the particles of the universe. These masses are but aggregated infinitesimals, and the same law which governs them governs the congregated mass. We have but a multiple of infinitesimals, which in their ultimates are force or life units. We have then the eternal swelling from the centre, and the eternal repression, hence an interaction within an interaction, and arrive at Malpighi's littles (as polarised units); at Grove's correlation of forces (as transfusion or transference), at Darwin's evolution (as development). We have the grand generalisations, as principles, as the methods or working facts of nature; and hence can view the universe in its physics, as a machine. As Helmholtz says, we can have no mechanics without intelligence; we have in intelligence the directing power, the beyond, through which all was and is.

that scientific teaching consists in something more than suppositious inferences.

If Huxley adhered to his definitions we should be spared from such *à priori* assumptions, contrasting so unfavorably with his lecture on "a piece of chalk;" his addresses to learned societies; his comments on palæontology, ethnology, and biology. Wild dreams flow sometimes from purely philosophical sources—the idiosyncrasy of talent. If the object of a lecture be amusement, it is attained by the probable and the absurd, spiced with a crumb of science, and half thinkers and no thinkers leave the room simpering in their own satisfaction. If, on the other hand, it be to instruct, no hypotheses or assumptions, however dogmatically insisted upon, can stand in the place of details, the results of observation, experiment, and thought. Virchow is great on the point. He says:

> "We should submit to the student the real knowledge of the fact in the first place, and if we go further we must tell him this is not proved . . . . but this is *my* opinion, *my* idea, *my* speculation." "That which is known and that which is only supposed, as a rule, get so thoroughly mixed up that, that which is supposed becomes the main thing, and that which is really known becomes only of secondary importance."

Facts we know on proof, and accept the forces by which they are induced as principles, acting through the particular conditions of law which govern them; we know little else. We can practically apply a principle, but the application of it does not involve an entire knowledge of its powers. Science is an aid to philosophy; but all scientists are not philosophers, nor all philosophers scientists. Virchow, in his comment on the addresses of Häeckel and Nägeli, at Munich (1877), says:

> "If any one wants by any means to connect mental phenomena with those of the rest of the universe, then he will come necessarily to transfer mental processes as they occur in man and the animals of the highest organizations to the lower and lowest animals, and afterwards a soul is even ascribed to plants Further on the cell thinks and feels, and finally he finds a passage down to chemical atoms, which hate, or love one another, or flee from one another. All this is very fine and excellent, and may after all be quite true. *It may be,* but I do not know in what I am to recognise all this."

No wonder Huxley expected doubt where he announced the protoplasm as "the physical basis of life;" and that "such a doctrine . . . appears almost shocking to common sense." He might have said that the platter was the physical basis of that which is on it, in the sense of the text. The only fact of the protoplasm is the vital fact, the compounds, the vehicle through which the effect, life, is presented, so the plate is the vehicle of that it contains. The life and the substance on the plate, are each distinct presentments, empirically subsisting. We may collect the materials of the protoplasm and subject them to every process which art can devise, yet the life in them would be perdue as in a stone. The reasoning on this subject points rather that the vital energy moulds the compounds, collecting the environments and creating its own conditions; their intermingling in different ratios presents the variety. Theine and strychnine are identical in their elements, but differ in combination. The foraminifera shells are exquisite in construction, but the jelly-spot within, through its vitality, without parts, without organs, without detected structure of any kind, builds these wondrous mansions. Physically we can simulate properties and forces; but we cannot change one substance into another. In isomeric substances we have butyric acid and acetic ether, with exactly the same composition, the same chemical formula, the same vapour density and specific gravity, but art cannot change the rank pungency of the first into the delicious aroma of the latter, because there is behind a chemistry which places science at fault, as in vital action there are mechanics unknown to us.

In animate forms we find a tracery of nerves which spring from or converge in a principal organ, but it does not follow that consciousness and motive power acting through them are ingenerated by them, any more than we can say the conductors generate the electric power. In an open circuit there is no exhibition of force, close the circuit and the spark ensues, because the condition necessary for its display is presented.[1] We have the latent and the active form in all processes of Nature; she marshals her forces, by the fact of her law she closes the circuit, and we have the resistless whiz of the electric fluid. So it is with life.

We will consider the protoplasm as a fact without the assumption, "the physical basis of life." The organless protamœba, the plant, animals, and man have all the same ultimate organic composition; the nucleated or non-nucleated cell-germ or seed. This community of organism pervades the realm of life, with faculty, form, and "substantial composition." When we are told "manifestations of intellect, of feeling and will . . . are not excluded from this classification, inasmuch as to every one, but the subject, they are known only as transitory changes in the body," for "all are resolved into muscular contraction, and muscular contraction is but a transitory change in the relative parts of the muscles" (L. S.), we demand to know what intellect, feeling, and will have to do with muscular contraction, excepting as the means of their manifestation. We create distinctions and differences, but when we go to nature they fade into homogeneity. Muscular contraction is an effect of vital energy set in motion by an act of the will or of sensation, and those processes, so dwelt upon as automatic, are vitally directed facts, although unconsciously manifested.[1] If every functional motion were consciously enacted, life, instead of having its pleasures and moments of repose, would be occupied by an anxious consciousness, and we should be constantly dwelling on the movements of the organization (*vide sup.* note 2, p. 16). It is not because our organic functions are unconsciously conducted that they are without sensation. All we know of sensation is that its fact is impressed on the consciousness; and when we become conscious of the irritability of a nerve, were such consciousness continuous, sensation would be an agony. On a diagnosis of the facts we must assume there is sensation in every organic function, because on derangement we become conscious of it. In a perfect automatic theory pain would be the normal and its absence the abnormal state of the organism. In consonance with all phenomenal facts we may assume consciousness to have latent and positive qualities, although passive to impression.

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[1] A beautiful idea is presented of unity in the mechanics of nature by Hughes's "Microphone," whereby we have a philosophical explanation of the echo. His experiment shows substances are "resonant." The same principle is found in the echo bounding from rock to rock, and in the whispering gallery of St. Paul's where articulated words may be heard in any part of its circuit. The microphone realizes Malpighi's idea—that all, by which we are surrounded, are accumulated littles. Sounds made apparent in the experiments do not accord with the rule of the inverse square, as they appear to magnify with the square of the surfaces of contact,—the "walk of a fly" is rendered audible, and "the delicate rubbing of a fine camel hair pencil over a smooth wooden surface." Of course the irrepressible molecule appears. The editor of 'Nature' says, "It is not too early, however, to see that we have in the microphone a new method of attaching and qualifying molecular motions."—(*Nat.* v. 18, p. 58.)

If muscular contraction, as a transitory change, creates consciousness, will, mind, and sensation, then every motion produces them; what then becomes of the automatic theory[2]—voluntary and involuntary actions?[3] In a living form muscular contraction is due to vital energy. Frog antics induced by external stimulants may remotely simulate life action, so a twitching in the limb of a paralysed patient may be excited by a stimulus. If this be the same power as that manifested by vital action, how is it when the muscular contraction ensues that the patient does not walk? as undoubtedly he would do were the parallel true. Unbiassedly examined the examples prove the contrary of the hypothesis, and show that the vital energy is not inbred by the organism but that the organism requires an impulse external to itself to incite it to motion. If this be true of muscular contraction how can we say this "transitory change" induced by will created "manifestations of intellect, feeling, and will?" We may have electrical action as the method of nature, but we cannot say the physics create vitality.[1] Exactly what occurs in a machine made by art occurs in the human machine—in the latter the inciter, vitality, and will, acting through a directing intelligence, in the former, manipulations intelligently directed, determining action.

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[1] A machine might move of itself we may grant, but what constructed the machine so that its movements might answer the purposes of life? How came the candle in the candlestick? How the fire on the hearth? Did they "fall into their places by the casual operation of gravity."—(*Vide Whewell, B.T.*, p. 172).

[3] Erasmus Darwin ascribes conscious action (automatism) to the irritation of a nerve inducing muscular association. He says, "when I am walking in that grove before my window I do not run against the trees or benches, though my thoughts are strenuously exerted on some other object . . . . the idea of the tree or bench . . . . exists on my retina and induces by association the action of certain locomotive muscles; though neither itself nor the actions of these muscles engage my attention.''—(*Zoonomia*, v. i., p. 50.)

[2] "The lowest stage of vitality and irritability appears to carry us beyond mechanism, beyond chemical affinity."—(*B.T. Whewell*, p. 147.)

S. T. Coleridge's hypothesis, as interpreted by S. Watson, defines—

> "*Life as a principle of individualization*, or the power which unites a given *all* into a whole which is presupposed in all its parts." Thus Reproduction corresponds to magnetism, Irritability to electricity; sensibility, constructive, or chemical affinities, are all results of magnetic polarization, the power to connect or disconnect, to retain or produce attachment. Individuality is "the one great end of Nature, her ultimate object, or by whatever word we may designate that something which bears to a final cause the same relation that Nature herself bears to the supreme intelligence." "The most general law is polarity, or the essential dualism of nature, arising out of its productive unity and still tending to reaffirm it, either as equilibrium, indifference, or identity. Life then we consider as the copula, or union of thesis and antithesis, position and counter-position—life itself being positive of both; as, on the other hand, the two counter points are the necessary *manifestations* of life." Thus in the identity of the two counter powers life subsists, in the strife it consists, and in their conciliation it at once dies, and is born again into a new form, either falling back into the life of the whole, or starting anew in the process of individualization (*Theory of Life*). There are many hypotheses of life, but to modern science is due the discovery that life and mind are derived from matter and muscular contraction.

In nature—the same law every where appears[1]—the same habits and conditions in the varied forms of life, modified to suit particular needs. In the main ramifications the vascular, nervous, and other systems differentiated hold true in all forms.[1] In the fœtus can be traced the progression of the new forms of life.[2] Commencing with the "jelly-blob," the distinctive characteristics can be traced through the grand gradations of living forms;[3] the intermediate links cannot be shown, but the types are always apparent.

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[1] The millions of millions of particles which the world contains must be finished up in as complete a manner, and fitted into their places with as much nicety, as the most delicate wheel or spring in a piece of human (art) machinery (*B.T. Whewell*, p. 146). He enquires, "What are the habits of thought to which it can appear possible that this could take place without design, intention, intelligence, purpose, knowledge?"

> "Gestation acts by development through inferior types, and brings the being to maturity when its point of development is reached. Thus the fœtal condition would reach a certain point. If the fish diverges, the reptile, bird, and mammal go on together, and in turn diverge; the reptile first, then the bird, The structural organization continuing, in the mammal reaches the highest point of organization. This generalization shows the main ramifications—the differences of orders, tribes, families, genera, and varieties can be imagined, and when an almost illimitable period of time is introduced, we have probably the programme of the workings of nature. An ephemeron viewing a tadpole in the morning (its youth), seeing the same in the noon (its age), could not assume the brachiæ would change and be replaced by lungs, nor that the tail would be erased and feet formed, and that the land would be its future habitat. The work of nature is done in æons of time. Man's life and that of the ephemeron in these stretches of time are on a par. The changes come in periods, like those of the calculating machine; the law continues its force to a certain point, then interposes a condition, a change appears, and so may be traced the diversities of natural phenomena." (*Vide* '*Ves. Creat.*,' p. 212, *et seq.*)

All living things grow and reproduce their kind, and have irritability and contractibility; the nettle owes its irritating power to stiff needle-like delicate hairs which taper "from a broad base to a slender summit," readily penetrating and breaking off. This hair has a delicate outer casing of wood, within is a fluid matter full of granules—"protoplasm." Under the lens it appears to be in continual activity, streaming up one side and down the other;

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[1] "We recognise the bones of the hand in the fin of the whale, in the paddle of the turtle, and in the wing of the bird. We see the same bones perfectly suited to their purpose in the paw of the lion or the bear, and equally fitted for motion in the hoof of the horse or in the foot of a camel, or adjusted for climbing 'or clinging' in the long-clawed foot of the sloth."—(*Bell*, '*Brid. Treat.*' p. 21.)

Cuvier says: "Never do we see in nature the cloven hoof of the ox joined with the pointed fang of the lion; nor the sharp talons of the eagle accompanying the flattened beak of the swan." Galen asks, How happens it "that the teeth and talons of the leopard and lion should be similar, also the teeth and hoofs of sheep and goats?"

[2] The extraordinary fact of animated life is the infinite variation of a fundamental plan modified by conditions, radiations from given centres, or divergencies from particular forms. ('*Ves. of Creat.*' 2nd ed. p. 119.) This idea amplified, and we have the modern theory of evolution.

"From the moment of birth there is a new impulse given to growth." "Few are aware the fœtus has a *life* adapted to its condition, and . . . . if protracted beyond its appointed time must die . . . . because the time is come for a change of its economy."—(*Bell*, '*Brid. Treat.*' p. 146.)

[3] All analysis tends to show the oneness of design in creation—the dependence of each fact on the *purposeness* of the whole, and thus we are irresistibly compelled to admit the unity of the power of which phenomena are but diversified manifestations.—(*Vide* '*Carpenter Pres. Ad.*')

sometimes diverging in different routes (*vide* L. S.). In the nettle is found the same fact as in the virus of the viper.

Protoplasm is a name applied by Mohl to the colourless, or yellowish, or smooth, or granular viscid substance of nitrogeneous composition, the formative substance in vegetable cells, which the Germans call *schleim*, and the English mucilage or mucus. The surface of the protoplasm pelicle, he regarded of the highest importance, and named it the primordial utricle; this primordial utricle Huxley called protoplasm, but formerly he restricted the term to matter within it, and he regarded it as an accidental modification of the endoplast and of little importance. The varioles of his periplastic substance are now tenanted by simple or nucleated protoplasms, endowed with subtle influences; this is immaterial, supposing the vital principle is meant. Max Schultze called the active moving matter, forming the sarcode of the Rhizopods, protoplasm, as well as the substance circulating in the cells of the Valisnaria, the hairs of nettles and other vegetable cells, and the active moving matter constituting the white blood corpuscules, and other contractile bodies variously distributed. Contractility is held by some to be the peculiar characteristic of the protoplasm. This was the view of Kühne, who included different forms of muscular tissue in the same category as the amœba and the white blood corpuscules. Muscular tissue exhibits structure which the amœba is said not to do. Beale says the living matter of the cells corresponds to the substance of which the white corpuscules, pus corpuscules, &c., are composed. "In all living beings the matter upon which existence depends is germinal matter, and in all living structures the germinal matter contains the same general characters." This he calls bioplasm, and contends the term protoplasm should only be applied to living substances. The author of the '*Vestiges of Creation*' says, white blood corpuscules are produced by the expansion of contained granules, and are multiplied by fission.

The nucleated mass of protoplasm is the structural unit of the human organism. The lowest forms of life find their repetition in the blood corpuscules; the polype (coral builders) are analogous in class. In plants the protoplasm appears in a sheath; in ova within a sac, or as a jelly mass, or speck with no external skin, with or without a nucleus. The grand divisions of the kingdoms of life were instituted for convenience. All living forms are cognate as to origin, however they differ in function; this shows an initiatory and inherent power active and acting in a given

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[1] Even in "the lowest creatures the sense of touch implies the comparison of two distinct senses."—(*Bell, B. T.*)

direction. The calc spar can be resolved into carbonic acid and quick lime, and resolved back to carbonate of lime, but art cannot re-form the calc spar. We may simulate nature; two colourless cold liquids may be mixed and there will follow an exhibition of heat accompanied by considerable ebullition. Again, two colourless liquids on admixture will glow vividly with colour; again mix two colourless liquids, and, after stirring, the solid rock will grow before our eyes. The facts appear, but we do not know why the heat and motion is evolved in the one, why the colour glows in the other, or why in the third cohesion has taken place. The modus of phenomena is shown, the initiative escapes us; a law is found in their recurrence, but the motor power is beyond our purview.

If the protoplasm, be a living substance, as Beale insists, no animal or plant can make it. By it they live and multiply through vital power. When the life ceases we have again organic substance, nothing remaining, save structure. To affirm that plants make protoplasm and animals exist by taking into them formed protoplasm, is not consistent with the natural fact. The protamœba absorbs its fellow, but where, excepting in the very earliest forms of living substances, do we find its repetition, however significant it may be as showing, that absorption is the generative fact of vitality. The granules by the same process increase by collecting the environing gases necessary for nutrition, the growth being from the centre. In the simplest forms (cells) the protoplasm is found, all animal forms being composed of cells; we have millions of absorbing machines bound into one by a directing vitality.[1] When we are seriously told matter forms, in the sense of creating, life and mind, sense and feeling, in the hocus-pocus of such material changes we have a thaumaturgy far more astounding than the *decried* miracles of the creeds. Life in one form is necessary to life in another form, and life inbreeds life in due successions; a resulting homogeneity.[2] As each particle of the great whole we term, the universe is relative to and necessary for the maintenance of the other particles, they can be neither wasted nor destroyed. This is due to the inherence of vital action; the consonance of nature. The potence of life first appears in the germ, in the core or nucleus of the living substance. So we might speak of the core or nucleus of the universe, whence the energy of being emerges and diverges to its circumference; knitting and bonding all by an "iron law," multiplied in its conditions, directed by an intelligence, which conceived its purpose, resulting in an orderly fact infinitely diversified.[1]

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[1] "God," as was said by the ancients "works by geometry."

[2] If it be admitted that "the life principle is modified to meet the requirements of its environments" (*Spencer*), how would it be possible to predicate any recurring animal form? And if it be, as doubtless it is, that the life principle modifies the environments, then the recurring form becomes the continuity of a precedent effect.

When the mechanics and chemistry of nature are dwelt upon it were proper to confine the words to their true signification; it is well to say mechanical this and chemical that, &c., for they designate the facts of nature which does its work through the appointed means. Earth may be eulogized as "the great mother" out of whose womb proceed all things. The earth is the matrix, the vehicle or bearer, but does not initiate any thing—the storehouse of elemental substances, the great natural vat from whence the vital principle dips that it wants. Earth (matter) supplies the materials in which the life subsists, but it is the vital power which converts the inorganic into the organic; and when, by the wear of its action, the energy supplied to the material is exhausted, it is exuded and the organic again becomes the inorganic. Thus we have the ever-recurring round,—vitality supreme, energy exhausted and energy rehabilitated. A watch marks the lapses of time by the perfect adaptation of its parts and their action; so nature exists through the perfect homogeneity of its parts and their action. Intellect *created* the homogeneity of the parts of the watch by which its action became possible, and, as materialists insist on parity of reasoning, we can say Intellect *created* and perfected the homogeneity of the parts of that mechanism we term nature. If we cannot "quite comprehend the *modus operandi* of an electric spark which traverses a mixture of oxygen and hydrogen," it seems presumptuous to suppose science can comprehend the more intricate mystery, life, and present "the physical basis." *It may be all quite true but there are no proofs.* "Martinus Scriblerus" and his "meat jack" is quite in analogy with the physical accountings for the being of life, sensation, intellect, and consciousness. Scientific language "should be precise and definite, and define facts and their action." The prevailing fashion, the adoption of a materialistic terminology, does not make a thing to be other than it is, despite the ingenuity of our professors, it only gives an inaccurate idea, by substituting "the *nomen* for the *numen*."[2]

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[1] "The heavenly bodies in their motions through space are held in their orbits by the combination of a power, not more wonderful . . . than that by which a globule of blood is suspended in a mass of fluids—or by which in due season it is attracted and resolved; than that by which a molecule entering into the composition of a body is driven through a circle of revolutions and made to undergo different states of aggregation, becoming sometime a part of a fluid, sometime an ingredient of a solid, and finally cast out again by the influence of living forces."—(*Bell*, '*Bridg. Treat.*,' p. 231.)

[2] The readers of modern treatises on science and attendants at lectures should have their reason so armed as to form independent conclusions; then by the habit

CHAP. II.

THE PHASES OF GERMAN THOUGHT.

Nägeli, Haeckel, and Virchow.—The Ape Ancestry.

At the jubilee meeting of the German Association, held at Munich, 1877, addresses were delivered by eminent German physicists. The addresses of Nägeli and Häeckel were expositions of popular ideas. The opinions delivered by these gentlemen were combatted by Virchow. These addresses, pertinently bearing on the subject of this treatise, are condensed from the reports in 'Nature' (vols. 16 and 17), where they *first* appeared in an English publication.

The axiom of Du Bois Reymond is "*Ignoramus Ignorabimus.*" That of Nägeli, "*We know and we shall know, if we be satisfied with human insight.*" Virchow more modestly says, "*That which honours me is a knowledge of my ignorance.*"

The inaugural address at Munich was delivered by Pettenkofer. He said: "If knowledge be power . . . . then among sciences natural science is . . . . destined to play a great part, perhaps the greatest in the history and culture of mankind. Natural science has but to look for facts and truths, and never need busy itself about the immediate practical application of what has been found."

ON THE LIMITS OF HUMAN KNOWLEDGE.—NÄGELI.

Among many practical and scientific men the opinion is widely spread that a certain and lasting knowledge and understanding of natural phenomena is on the whole impossible; and they think that scientific theories, generally, are only attempts to approach the inaccessible reality; and change their tenor and expression with the views of the time. This law is not a view based on principles, but only despair caused by failure, the necessary consequence of wrong method and of scientific incapacity. The problem of natural phenomena is an algebraic equation with many unknown factors; the solution is only possible if just as

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of "intellectual effort" they would be enabled "*to discern the truth from a phraseology which has only the appearance of truth*" (*Helmholtz's Rectoral Lecture, Berlin*, 1878).

many equations can be obtained as there are unknown factors, and if the same unknown factors are obtained in all; as this is impossible, we try to get an equation in which there is only *one* unknown factor. This is done by *scientific* experiment, in which all unknown factors are removed, save one. A snail, which takes the straight road for its goal, progresses, while a grasshopper, with its bounds in all directions, remains always on the same spot. Thus scientific investigation proves that by an exact method certain and permanent knowledge of natural phenomena may be gained.

The opinion is that belief begins where knowledge ceases, but with this our interest is not satisfied. We wish to know whether the limit where human knowledge must stop can be determined. What is the fundamental difference between knowledge and belief? From two sides the absolute power over nature is claimed with certainty; with decreasing energy by natural philosophers, with increasing energy by materialists. The former think they can construct nature out of herself, and natural knowledge for them is finding the concrete natural phenomena for the constructed abstract ideas. The latter only admit force and matter in time and space, and that Man, built up of matter and force, shall master nature, which is built up of the same factors.

Du Bois Reymond, on the same subject, arrived at three conclusions:—1. Natural knowledge or understanding is the reduction of a natural phenomenon to the mechanics of simple and indivisible atoms. 2. There are no atoms of this description, and therefore there is no real understanding. 3. Even if we could understand the world through the mechanics of atoms, we could not nevertheless understand sensation and consciousness through them.

Nägeli says Du Bois Reymond does not go beyond this negative. The investigation of natural sciences cannot define the limits of a domain she does not possess, and in their incompleteness leads to false deductions which contradict our natural scientific conscience. We must go beyond the negative side and examine whether the human mind is not capable of natural knowledge, and of its nature and extent. The way in which I understand nature is determined by the answers to the following questions:—1. The condition and capacity of the *Ego*. 2. The condition and accessibility of nature. 3. The demands which we make of knowledge—subject, object, and copula participate in the conclusion. The capacity of the *Ego* is our power of thinking, in whatever condition it may be, and only gives us nature as we perceive her by the senses. Our knowledge is only correct in so far as observation by the senses and internal perception are correct, the probability being that both lead us to *objective* truth. Scientific analysis shows that in the totality of force-endowed matter—the world—each particle of matter, all its inherent forces, are in relation to all others. It is influenced by all, and, in its turn, acts upon all; the effect which it causes and receives is the total effect of all the single particles; but these effects are so insignificant, as regards the infinite majority of cases, that they are neglected because imperceptible. Man and the higher animals have certain parts in them developed into organs of sensation by which they are sensitive to certain natural phenomena, and have been developed from the smaller beginnings to high degrees of perfection.

The idea of Darwin, that in organic nature only such arrangements attained full development as were useful to the bearer is simple and reasonable; sensation corresponds, and is exactly portioned to the requirements of the organism. We are sensitive to temperature and to light, for they are necessities; but we are not organised to perceive the electricity which surrounds us. We perceive the increase and decrease of heat and light, but we do not know whether the air contains free electricity, nor whether it is positive or negative. We touch a telegraph wire but find no result. We can imagine the atmosphere without the lightning and the thunder, but their presence has helped us to our knowledge of its fact. Had not accident revealed the attractive and repulsive force generated by friction, it is probable we should have no idea of electricity. Our senses are organized for the requirements of our bodily existence, not to satisfy our intellectual wants; to acquaint us with and to explain all phenomena of nature. If they perform this function only incidentally, we cannot rely on them to explain *all* phenomena of nature; it is indeed very probable that there are still other natural forces, other forms of molecular motion of which we obtain no serious impressions, because they never unite to any remarkable outcome, and therefore remain hidden from us. We are probably deficient in the power of sensation for the whole domain of natural life, and, as far as we can have the power, it is confined in time and space to an insignificantly small part of the whole.

Our natural knowledge is not confined to what we perceive by our senses; by conclusions we attain to a knowledge our senses do not reach. The knowledge of the place of Neptune was obtained by calculation.[1] We know, although the best microscopes do not show it, that water consists of infinitesimal particles, or molecules, which are in motion. In other preparations of water we know the proportionate number and weight of the particles composing it. By the conclusions drawn from facts we know facts not perceived by the senses. We may therefore indulge the hope that starting from the small domain open to our senses, little by little the entire field of nature will be conquered by reason; but this hope can never be fulfilled. As the effect of a natural force decreases with its distance, the possibility of knowledge also decreases as the distance in space and time increase. Thus, the condition, the composition, and history of a fixed star, of the life in its satellites, of the material and spiritual movements in these organisms, we cannot know anything, nor of the discovery of a still unknown natural force, of an unknown form of motion, of the smallest material particles; the less this force or motion possesses the peculiarity of accumulating and causing collective effects the more it eludes us. The confined capacity of the *Ego* allows us only an extremely fragmentary knowledge of the universe.

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[1] Before the scientific world knew that Le Verrier and Adams were calculating the disturbing cause which led to the discovery of the planet Neptune, a clairvoyant or mystic somnambulist (Andrew Jackson Davis, U.S. America, then a lad utterly uncultured, unlettered, and ignorant of science), predicted, when in a somnambulistic state, there was another large planet belonging to the solar system beyond the orbit of Uranus (in fact two). The calculations of Le Verrier and Adams were

The boundaries which nature opposes are more evident if we adopt the hypothesis that man has the most perfect capacity for natural knowledge. If time and space did not exist then every phenomena could be judged in the past as well as in the present. The largest stellar systems as well as the minutest atoms would be in purview; for if man were provided with perfect senses then all the phenomena of nature, all forces and all forms of motions, would be perceived directly by him. La Place says: "A mind which for a given moment knew all the forces which are active in nature, and the respective positions of the beings of which she consists, if it were comprehensive enough to analyse these data, would unite in the same formula the motion of the largest heavenly body and the lightest atom. Nothing would be uncertain;—the future as well as the past would be present to its gaze.

The human mind, in the perfection which it has been enabled to give to astronomy, offers a weak reflection of a mind of this description." This mind would not solve the problem given. La Place starts from the finiteness of the world in all directions; but this finiteness is not given. The difficulty nature opposes to human knowledge is its *endlessness.* In space nature is endless.

not then made public, and consequently before their calculations were verified by its discovery the prediction was made. The evidence of this fact is preserved, and if it be possible for human evidence to be complete *this is so.* He also announced Faraday's discovery of dia-magnetism, giving the details before the discovery was known in America, and named Faraday as the discoverer. This evidence is also complete. This is one of those peculiar mental facts to which physical science has no key

To travel with the speed of light (192,500 of miles in a second) through the known universe of fixed stars would require some 20,000,000 of years, according to a probable estimate. If in thought we placed ourselves at the end of this immeasurable space we should still see a new starry firmament, and as the earth appears our centre of the universe, we should peer on the beyond and still imagine we were in the centre of the universe. The starry heavens we now see, compared with the universe, are after all, infinitely smaller than the smallest atom compared to the world.

What applies to space applies equally to the groupings in space, to the composition, organization, and individualization of matter; the object of morphological natural science. All consist of parts, itself a part of a bigger whole. We have organs composed of cells, and these of smaller elementary particles; further we get chemical molecules and atoms of chemical elements; these resist further subdivision at present, and are considered as compound bodies on account of their properties; but no physical atoms strictly can exist, no little particles which would be really indivisible. Size is but relative; the smallest body in existence which we know, the particles of light, heat, and ether, may be of any size we choose in our conception—even infinitely large, if we imagine ourselves sufficiently small by side of it; indivisibility never ceases. The *composition* of individual particles, separated, continues endlessly downwards or upwards in continually larger individual groups. The heavenly bodies are the molecules which unite in groups of lower and higher orders, and our whole system of stars is only a molecular group in an infinitely larger whole, which we must suppose to be a unit organism, and only a particle of a still larger whole. As space is endless in all directions so time is endless on two sides, it has never begun and will never cease. The Bible teaches In the beginning God created the heaven and the earth. Geologists say: In the beginning the world was a gaseous mist, from which heavenly bodies were formed by condensation. But this beginning is only a finiteness, and the time which has passed since this beginning is only as a moment compared to the eternity before. From the union of time and space, an empire of phenomena results. Matter in motion which fills space, the particles of which act on one another and then with diverse forces (attraction and repulsion), motion causes motion and a change of motion, and this is the chain of cause and effect; an endless one—it neither could begin with a first cause nor finish with a last effect.

Nature is everywhere uninvestigable where she becomes endless or eternal ; we cannot *conceive* her as a whole, because that which has neither beginning nor end does not lead to conception, and this is why La Place's problem is futile from the beginning. A formula is unthinkable for which we have not component factors, and which if these factors were given would never come to an end. A formula of this kind would give us, as astronomical calculation really does, a solution correct within certain limits, a practical solution, not a fundamental one.

The investigator of nature finds his investigations limited in all directions, for the uninvestigable eternity bids him stop. The infinitely large and the infinitely small have been mixed with endlessness and nothing, leading to erroneous conceptions. Amongst them are the theories of physical atoms on the one hand and the beginning and end of the universe on the other. Matter constituting the heavenly bodies is supposed in the beginning to be gaseous ; in this Du Bois Reymond finds a difficulty. If this matter had been at rest and distributed equally he cannot find out whence motion and unequal distribution have come.

The condensation of matter has gone on for an infinite time ; we have the nebulæ, then burning liquid drops which cool down to dark bodies. The world is a condensed and no longer an incandescent world drop. The still incandescent already dark heavenly bodies must give off their store of heat to universal space. By-and-by they must fall upon one another, and if a local rise of temperature takes place this only serves to accelerate the process of cooling on the whole. At last, all heavenly bodies will unite in a dark, solid icy mass upon which there will no longer be motion or life. This is the result of correct physical consideration, and the consequence of our confined insight ; it would only be a logical necessity if we knew *everything.* But we see but a small part of the universe, and possess but a fragmentary knowledge of the forces and forms of motion in the part we know ; our deductions may be without perceptible error for billions of years, but with the lapse of greater periods they must become more uncertain and eventually be totally erroneous.

In illustration, we are most certain of the incandescent state of the earth at one period, and by analogy conclude that the other planets were incandescent bodies, as the sun is still. Going backwards from suns we get to accumulated masses of clouds, the embryos of later suns, then to cloud belts, eventually to the gaseous mass distributed with tolerable uniformity, beyond which, with our present insight, we cannot go. This proves a constancy of change, each change consisting of a sum of motions and supposes a former change, or sum of motions, from which it resulted with mechanical necessity, and, further on, a chain of changes from all eternity; and if our scientific insight does not lead to this, does not justify us in this supposition, it proves only its inadequacy. On the contrary we must conclude that the series of developments of the heavenly bodies is only one of the numberless successive periods, and that analogous periods and consequences have preceded and will follow endlessly. We know a mass of gas in a state of progressive condensation produces heat, and how the hot condensed mass again gives forth this heat, until its temperature is that of its surroundings, but we do not know how the solid mass can again become gaseous, and how the necessary heat distributed in space can again be collected. This gap we fill with suppositions. The example shows we may use our experiences of the finite only for deductions within the finite. As soon as man wishes to overstep this domain opened to him by his senses, and which is accessible, and wants to form a conception of the whole, he falls into absurdities; either he leaves what is gained by experience and meditation, and then loses himself in arbitrary and empty fancies, or he proceeds logically by the laws of the finite, and then he finally arrives at perfectly ridiculous consequences. Supposing we follow changes according to the laws of causality, we arrive at the standpoint of nebulosity, and adopt what is known there as the measure; then we find stages both in the past and in the future which more and more approach to perfect rest without ever reaching it. But if we suppose the heavenly bodies and systems arise and perish without end in the universe, we find two possibilities: according to the materialistic conception the successive changes are of the same value, or according to the philosophical conception they continually change their relative value, becoming more perfect every time, in which case the universe in the eternal past would more and more approach absolute imperfection (therefore rest), and in the eternal future absolute perfection (therefore again rest). These conceptions are equally irrational. The first (physical) and the last (philosophical) let the world awake from dead rest and return to it; the materialistic conception condemns it to eternal rest, because a change which always repeats itself means for an eternity nothing else but rest. With space we do not fare better than with time. As space filled with matter can but everywhere be limited by more space filled with matter, we arrive at the absurd deduction that the world in its circumference is bordered by itself. If we allow infinity to universal space, then heavenly bodies follow on heavenly bodies without end. Thus we arrive at the mathematically correct, but, according to our ideas, absurd deduction, that our earth, just as it now is, must occur several times, indeed an infinite number of times, in the universe. The examples show our finite reason is only accessible to finite conceptions, and when we wish to raise our conception to the Eternal we fall back upon finite and obscure ideas.

All conceptions are exclusively the results of sensuous perceptions, and our knowledge cannot go further than to compare the phenomena we have observed and judge of them with reference to one another. The comparison of many phenomena gives a unit by which we can measure and determine; we therefore obtain as many measures as there are properties in nature, and, as they are reduced from finite facts, they have only a relative value. We may not only compare different objects and measure them one by another, but also a system, a unit group of things of similar nature with itself and measure it by itself. The knowledge is complete if the later stage be proved to be the necessary consequence of the earlier one, or the earlier the predecessor of the later. In the elementary domains of the material this causal relation is the mechanical necessity. In higher domains of the material we cannot from our causal knowledge uphold the demand for this causal necessity. As in the case of structure, it cannot be definitely explained why the origin of a chemical compound and of a crystal must be the necessary result of known forces and motions of elementary atoms and molecules; still less in cells and the growth of organisms and propagation and the inheritance of peculiarities. Yet in these domains we may speak of causal knowledge with some show of right. A time will arrive when we need no longer presuppose ontogenetic and phylogenetic necessity as a matter of course, but when we shall also be able to understand its cause.

The mechanics of the heavens are based on general gravitation and centrifugal force, both are simple forces acting in a straight line; both are hypotheses resting on our experience, but of the reasons we are ignorant. If we were to demand that our knowledge of the "why?" should be clear there would be neither astronomical nor physical knowledge! Natural knowledge need not begin with the hypothetical and smallest unknown things. It begins wherever matter has shaped itself into unities of the same order, which may be compared to, and be measured by one another, and wherever such unities combine to form compound unities of a higher order. It may begin at every age from the organization or the composition of matter; at the atom of chemical elements which forms the chemical compounds; at the molecule of the compounds which composes the crystal, at the crystalline granule which composes the cell and its parts; at the organism, or individual, which becomes the element of the formation of a species. Each scientific discipline has its justification essentially in itself.

I have tried to determine the capacity of the *Ego,* the accessibility of nature and the essence of human understanding. It is easy now to fix the limits of human knowledge. We can only know that our senses acquaint us with, and this is limited in time and space to an infinitesimal domain, perhaps to only a part of the natural phenomena occurring in this domain, on account of a deficient development of our organs of sense. Of that with which we are acquainted we only know the finite, the changeable and perishable, only what is relative and differs by degrees, because we can only apply mathematical ideas to natural things and judge them by the measures we have gained from them. Of all that is endless or eternal, stable or constant, of all absolute differences we have no conception. We have a perfect idea of an hour, a metre, a kilogramme, but we have no idea of time, space, matter and force, motion and rest, cause and effect. The extent and limit of our possible natural knowledge may be shortly and exactly stated: *We can only know the finite, but we can know all the finite which comes within the reach of our sensory perceptions.*

When we consider the consequences which have arisen from a departure from a correct method based on principles, the most remarkable are, that finite nature is divided into two radically different domains, and particularly that there is an insuperable limit between the inorganic and the organic, or between material and spiritual nature. The antagonists of an intimate connection between material and immaterial nature draw the line of separation in different places; some ascribe living nature (life endowed nature) to plants; life is ascribed to represent something special, whilst others admit this only for the animal world endowed with sensation, and others only for the spiritually conscious human race; new immaterial, or eternal principles, are said to apply to higher grades. Du Bois Reymond holds the second of these views: He says, "that in the first trace of pleasure which was felt by one of the simplest beings in the beginning of animal life upon our earth an insuperable limit was marked, whilst upwards from this to the most elevated mental activity and downwards from the vital force of the organic to the simple physical force he nowhere finds another limit."

Experience shows the clearest consciousness of the thinker downwards, through the more imperfect consciousness of the child, to the unconsciousness of the embryo and to the insensibility of the human ovum, or through the more imperfect consciousness of undeveloped human races and of higher animals to the unconsciousness of lower animals, and of sensitive plants; there exists a continual gradation without definable limit, and that the same gradation continues from the life of the animal ovum and the vegetable cell downwards through organised elementary or less lifeless forms, (parts of the cell) to crystals and chemical molecules. The conclusion to be drawn by analogy is this: Just as all organisms consist of and have been formed of matter which occurs in inorganic nature, so the forces which are inherent in matter, have entered into the formation as well. If matter combines with other matter their forces unite to the same total result, and this represents the new property of the resulting body—thus life and feeling are the new relative properties which albumen molecules obtain under certain circumstances. Experience shows that spiritual life is everywhere connected in the most intimate manner with natural life and that the one influences the other and cannot exist without the other. As everywhere in nature forces and motions are united only with material particles, so the spiritual forces and motions only appertain to matter, *i.e.*, they are composed of the general forces and motions of nature and are connected with them as cause and effect. No naturalist can avoid the idea of a causal conception of this nature, unless he becomes unfaithful, consciously, or unconsciously, to his first principle. The problem is therefore to understand how the forces of inorganic matter combine in matter and form into organisms so that their result represents life, sensation, and consciousness. The solution of this problem is very remote; but it is yet possible.

The mind can indeed be looked upon as the secretion of the substance of the brain in the same way that the gall is the secretion of the liver as K. Vogt, and previously Cabanis had said.[1] According to Nägeli, Du Bois Reymond says the finite mind as it has developed itself through the animal world up to man, is a double one: on the one side is the acting, inventing, unconscious *material* mind which puts the muscles into motion and determines the world's history; this is nothing else but the mechanics of atoms and is subject to the causal law; and on the other side the inactive, contemplative, remembering, fancying, conscious immaterial mind which feels pleasure and pain, love and hate; this one lies outside the mechanics of matter and cares nothing for cause and effect.

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[1] It is difficult to see the similitude, the gall is an objective presentment proceeding from a material substance through vital action. The mind is not an objective presentment, how it should follow as a material consequent from a material substance is not clear.

Generally both sides of the mental life are called mind. If the separation existed as described, this would be truly the unintelligible secretion of the material mind, or of the atoms of the brain; it would not be anything but the useless ornament of this material mind, its infallibly following unreal shadow, because as standing outside the chain of cause and effect, it is powerless and without influence upon actions; without it the world's history would have run exactly the same course; therefore *without* a conscious and perceived mental life we should have thought, done, and spoken everything, but only mechanically, and not otherwise than a very artistically-invented dead automaton would think, act, and speak.

Can we imagine that so many occurrences which most evidently resulted from sensation and consciousness, have some other sensationless and unconscious origin? can we imagine that sensation and consciousness are so entirely useless, whilst every where utility is so evidently prominent in organic nature, that so useless and superfluous a phenomenon should occur just where we expect the greatest utility? Can we imagine that the causal principle which governs the whole of nature fails us just at the most important part? Can we imagine that organised matter accidentally and without cause acquires a property (sensation and consciousness) and loses it again accidentally and without effort, because in the *ovum* and in the embryo the conscious and perceived mental life would not be present, it would arise gradually, it would be lost in every sleep, obtained again more or less completely in the waking state, and be annihilated for ever in death?

It is quite correct for Du Bois Reymond to say we can only know the material conditions of mental life; but how life results from those conditions remains a secret to us for ever. It would be an error to suppose that we generally understand the origin of natural life from its causes. In all purely material phenomena we find the same barrier as in the mental ones. In the inorganic world the cause is lost in the effect; but we cannot understand the nature of the transfer. We know that two bodies which are apart, if there be no obstacles, approach one another until they touch; what induces the mutual motion is just as unintelligible, and will remain just as eternal an enigma as the origin of sensation and consciousness from material causes. The view is generally held, that nature in her simpler inorganic phenomena offers no difficulties to our conception. Whereas, in reality, the difficulties everywhere are the same in principle. Mental life is known by subjective experiences, and these Nägeli traces from irritations which produce sensations[1], whether in plants or animals, and he sums his conclusions by saying, sensation is therefore a property of the albumen molecules, and if it be granted in the case of the albumen molecules, we must grant it likewise to the molecules of all other substances. If the molecules feel something which is related to sensation, then this must be pleasure; they can respond to attraction and repulsion, we follow their inclination and disinclination; it must be displeasure if they are forced to execute some opposite movement, and it must be neither pleasure nor displeasure if they remain at rest. We have the gratification and offence of the molecules, but these different sensations are necessarily unequal with regard to conditions and intensity according to the forces acting. The simplest organizations which we know are the molecules of chemical elements, and, therefore, simultaneously influenced by several qualitatively and quantitatively different sensations which agglomerate to a total sensation of pleasure and pain.

If we look upon mental life in its general significance as the immaterial expression of material phenomena; as the mediation between cause and effect, then we find it everywhere in nature. Mental force is the capacity of material particles to act upon each other; the mental phenomenon is the manifestation of this action which consists in motion. So changes of the position of material particles and of the forces lead to new mental occurrences.

The cogency of the argument as to the materiality of the mind is summed in the following conclusions (which I have italicised): *Just as the stone would not fall if it did not feel the presence of the earth*, *so the trampled worm would not wriggle if it had no sensation*, *and the brain would not act reasonably if it had no consciousness.* We are then told natural science *must be exact;* must rigidly avoid everything which oversteps the limits of *the finite* and *intelligible*, and must *proceed in a strictly materialistic manner*, because *its sole object is finite* force-endowed matter. All that is eternal and stable, *the how* and *the why* of the universe, remains for ever incomprehensible to the human mind, and if it tries to overstep the limits of minuteness, it can only puff itself up to a ridiculously adorned idol, or desecrate the Eternal and the Divine by human disfiguration. Such are the reasonings which are to lead man to reject Du Bois Reymond's motto, *Ignoramus et ignorabimus*, and adopt that of materialism, which, according to Nägeli is, "we know and we shall know"!

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[1] Erasmus Darwin in his work '*Zoonomia*,' published at the end of the last century, draws similar deductions—he does not say pleasure and displeasure, but pleasure and pain—commencing in irritation, and so on. Bain, in '*Body and Mind*,' sets forth somewhat similar ideas. Have we then three thinkers independently arriving at the same conclusions? Such coincidences *do occur*, but they are not very frequent. Erasmus Darwin, although not a materialist, abounds in arguments (In his effort to prove the derivation of sensation and mind through irritations producing pleasure or pain), which might afford *handy weapons* for materialistic arguments.

Haeckel on Evolution.

No doctrine for the last decade has claimed such general attention; no other affects our important convictions so deeply as that of Evolution and the monistic philosophy united with it; because by this doctrine the question of all questions can be solved—the fundamental question of the position of man in nature. The highest principles of all science must depend on the position which our advanced understanding of nature assigns to man.

By the conception of natural selection in the struggle for existence, a firm foundation is afforded to biology in its department of morphology, Lamark, G. St. Hilaire, Oken, and Schelling have presented their conclusions. The natural philosophy of their time could only draw up a general plan of construction. Between 1830 and 1859 a strictly empirical investment of nature was flourishing, and two principal branches of real natural history started from totally different bases. Lyell's geology, and the history of the development of living creatures, animals, and plants; yet side by side with them stood the irrational myth, that every single species of animals and plants, like man himself, had been created independently of one another. The contradiction of the two doctrines, the natural development theory of the geologists and of the creation myth, was decided in favour of the former by Darwin in 1859. Since then it has been recognised that formation and changes in the living inhabitants of the globe follow the same great eternal laws of mechanical development as the earth itself, and the whole world system. Comparative anatomy and the history of germs, systematic zoology and botany, cannot be explained without the theory of descent; by it the relations of organic forms can be deduced; by it alone can we understand the existence of rudimentary organs, eyes which do not see, wings which do not fly, muscles which do not move, and which most emphatically refute the old system of *teleology*, because they prove in the clearest manner that the utility in the structure of organic forms is neither general nor perfect, that it is not the result of a plan of creation worked with an object in view, but necessarily caused by the accidental coincidences of mechanical causes.[1]

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[1] In the "Reign of Law" (p. 150 *et. seq.*) there is a description of the wings of birds; if they be the "*mere accidental coincidences of mechanical causes,*" we *must exclude*

In biology, the historical and historico-philosophical method takes the place of the exact mathematical. If the botanist fol-

all ideas of intelligence in nature, and all idea of such a formative fact as law originating from an intelligent cause.

The birds' wings, whether they be long, short, broad, or narrow, are exactly suited to the exigencies of the possessors. In the lifting the body of the bird there is a contravention of the laws of gravity, the dead substance of the bird weighing as much as the living. How then is this contravention of a special law achieved? By a lever, which is the bird's wing. The mechanical law is "a small amount of motion, or motion through a very small space, at the short end of a lever produces a great amount of motion, or motion through a long space at the opposite or longer end" (p. 151) This is exactly the motion "transmitted" to the end of a long wing. The albatross affords such an example. The bird sometimes accepts the aid of gravity, sometimes opposes it, as is exemplified in the power of exposing the wings at the exact angles which produce the desired effects, and is on the same mechanical principles which account for the resisting force of the narrow blades of a screw propeller. The quills of a bird's wings at the lower ends are called *primaries,* those from the mid vein *secondaries,* and those next the body *tertiaries.* "The motion of a bird's wing increases from its minimum at the shoulder point to its maximum at the tip." The propelling power of a bird's wing is distinct from the sustaining power, "and depends on the reaction of the air escaping backwards." "The perpendicular stroke . . . . has the double effect of both propelling and sustaining . . . . this brings two different forces to bear . . . . a direction upwards and one forwards," and arises from what mechanicians call "the parallelogram of forces." A kestrel will hang in air in a half gale of wind, "with wings folded close to its body, with no visible muscular motion," so nice 'is the adjustment of position' to produce this exact balance." The change of position results in a forward motion. The tail of a bird has not a function analogous to that of the rudder of a ship; it assists in the turning motion "and serves to *stop* the way of the bird" when it rises or turns to take a new direction, and also serves as a balance. "The whole order of nature is contrivance," and "that kind of arrangement by which the unchangeable demands of law are met." The distinction between a bird and a balloon is, birds fly, balloons float—the active and passive representations of force. The heron, one of the slowest in flight, is computed to make from 240 to 300 movements in a minute, with some other birds the velocity is so great the eye cannot follow it, ... the vibration of the wings leaving only a blurred impression." Connected with the forces (*supra*), the explanation of flight appears.—When a bird supports itself by the downward stroke of the wings, it must, at the end of each stroke, lift the wing upwards to the apparent danger of the neutralization of the force "for it must be made with equal velocity, and, if it required equal force it must produce equal resistance and an equal rebound from the elasticity of the air." The difficulty is evaded—*first,* by the upper surface of the wing being convex, the under surface concave. The air struck by the concave surface is gathered up, whilst that struck by the convex surface escapes on all sides. *Secondly,* "the feathers of the bird's wing are made to underlap each other, so that in the downward stroke the pressure of air closes them against each other, and converts the whole series into a connected membrane, through which the air cannot escape . . . . in the upward stroke the same pressure has a precisely reverse effect; it opens the feathers, separates them from each other, and converts each pair of feathers into a self-acting valve, through which the air rushes at every point." Thus the same implement is at one time a close continuous membrane impervious to air, at another a series of disconnected joints, through the interstices of which the air passes without resistance, "the machine being so adjusted that when pressure is required, the maximum of pressure is adduced, and when it is to be avoided, it is avoided by converting the continuous membrane into open valves." Thus is contradicted the dictum of Haeckel, that the mechanical contrivances found in nature are "not the result of a plan of creation worked with an object in view." But for the sequence of effects lowed the formation of the plant from the seed, and the zoologist from the *ovum* they considered the morphological task complete by observing the history of these germs. Wolff, Baer, Remack, Schleiden, and the school formed by them, understood until lately the individual ontogeny exclusively. Now the mystery of germs no longer confronts us as unintelligible. By the laws of inheritance, the changes of form the germ passes through are but an abbreviated repetition of the corresponding changes of form which the ancestors of the organism have passed in the course of many millions of years. If an egg is placed in the incubator, and in twenty-one days a chicken creeps forth, we are not astonished. The simple cell leads to the two-leaved gastrula, then to the worm-shaped and skull-less germ, thence to the further germ-forms, which, on the whole, show the organization of a fish, an amphibian or reptile, and lastly that of a bird. The series of the germ-form of the chicken gives a sketch of its ancestors. *The history of the germ is an extract from the history of its ancestors* occasioned by the laws of inheritance.,

The phylogenetic interpretation of the ontogenetic phenomena is up to the present time the only exposition of the latter; their common object is the investigation of historical events which happened in the course of many millions of years before man lived on earth. Phylogeny uses these historical archives in the same manner as other historical disciplines do; as the linguist, by the comparative investigation of living languages, proves their origin from a common ancestral language. Only the ignorant smile incredulously when it is said the chain of the Alps is but the hardened deposits of the bottoms of seas; the nature of the fossils they contain admits of no other explanation. The hypotheses of Phylogony and those of Geology differ in that those of Geology are more simple. The question of the origin of man is decided by the theory of evolution, or doctrine of descent. If the theory of evolution be true, if there exists a natural philogony, then man has resulted from the form *vertebrata*, from the class *mammalia*, from the sub-class *placentalia*, from the order *apes*. All attempt to shake this deduction, from the evolution doctrine, is futile (*vide infra*, p. 80). The phylogenetic archives of comparative anatomy, ontology and palæontology speak too distinctly in favour of an identical and uniform descent of all *vertebrata* from a single ancestral form, to permit our having any doubts now, thanks to the most illustrious morphologists, Gegenbaur and Huxley. It is often supposed that only the origin of the human

in the union of forces, the flight of the bird would have been an impossibility, and without an intelligent arrangement of all its parts it never could have been.

body is explained, but not that of our spiritual activity; in the face of this objection we must remember the physiological fact that our intellectual life is inseparably united with the organization of our central nervous system, which is composed exactly like that of all higher vertebrata and originates exactly in the same way.

Whatever we may imagine to be the connection of soul and body, of mind and matter, so much results from the evolution doctrine that at least all organic matter—if indeed not all matter—is in a certain sense animated. Microscopical investigation discloses that the anatomical elementary parts of the organism,—cells—universally possess individual animated life. Since Schleiden founded the cell theory for the vegetable kingdom and Schwann applied the same to the animal world, we ascribe to these microscopical life-beings an individual and independent life. They are the elementary organisms of Brucke and of Virchow (*Cellular Pathology*)

Naturalists now consider the cells no longer as the dead passive building stones of the organism, but as the living active state citizens of the same. This conception is confirmed by the study of infusoria, amœba, and other unicellular organisms—here we find with the single cells, living in isolation, the same manifestation of soul-life, sensation, conception, volition, and motion, as with the higher animals, composed of many cells, and the soul-life of the cell is tied to the cell substance—*protoplasm.* In the *monera* we see single detached pieces of protoplasm possess motion and sensation like the whole cell. Accordingly, we must suppose that the cell-soul, the foundation of empirical psychology, is a compound itself, viz. the total result of the psychic activities of the protoplasm molecules, which we will shortly call *plastidule.* The plastidule-soul would therefore be the last factor of organic soul-life.

Modern organic chemistry shows that the peculiar physical and chemical properties of an element, of *carbon*, in its complicated combination with other elements cause the peculiar physiological properties of organic compounds, and before all others of protoplasm. The monera, consisting exclusively of protoplasm, forms the bridge over the deep chasm between organic and inorganic nature. If, in spontaneous generation, a certain number of carbon atoms unite with a number of atoms of hydrogen, oxygen, nitrogen, and sulphur, to form the unity of a plastidule, we must regard the plastidule-soul, *i.e.* the total sum of its life activities, as the necessary product of the forces of these united atoms. In this most extreme psychological consequence of our monistic doctrine of evolution we meet with those old conceptions of the animation of all matter, which already in the philosophy of Democritus, Spinoza, Bruno, Leibnitz, and Schopenhauer, have found varied expressions, because all soul-life can finally be reduced to the two elementary functions of *sensation* and *motion;* to their reciprocal action in reflex motion. The simple sensation of inclination and disinclination, the simple forms of motion, *attraction*, and *repulsion*, these are the true elements out of which all soul activity is built in infinitely varied and complicated combinations. Monism avoids the one-sidedness of materialism, as well as that of spiritualism, it unites practical idealism with theoretical idealism, it combines natural science with mental science, to form an all-comprising uniform, general, or total science.

The recognition of common simple causes for the most varying and complicated phenomena leads to the simplification, as well as to the deepening of our education and culture; only by causal conception dead knowledge becomes living science. Not the quantity of empirical knowledge, but the quantity of its causal conception is the true measure of the education of the mind.

The conclusion of the lecture was a comment on Theology, &c.

VIRCHOW ON THE LIBERTY OF SCIENCE IN MODERN STATES.

Vichow, in his address, comments on those of Nägeli and Haeckel, denying their conclusions because not founded on scientific data.

In celebrating the fiftieth anniversary of this association, it is becoming to remember the change which has taken place in Germany since the days when Oken assembled the German naturalists and physicians for the first time. In 1822, the time of the first meeting at Leipsic, it was thought to be so dangerous to hold such a meeting, that it was held in perfect secrecy. Indeed, the names of the Austrian members could only be published in 1861. Oken, the valued teacher, died in exile, in the same canton in Switzerland in which Ulrich von Hutten ended his life, full of troubles and contests; the exile of Oken will remain the signature of the time we have gone through, and we should remember he bore all the signs of a martyr; we shall point to him as one who with his blood conquered and obtained for us the liberty of science. It is now easy to speak of the liberty of science when in calmness we can discuss the highest and most difficult problems of life and the hereafter. We have arrived at a point when it becomes necessary to investigate whether we may hope to retain securely the possession we enjoy, and we ought to ask ourselves what we are to do to maintain the present state of things. For the present we have nothing more to ask, our special task is to render it possible—*through our moderation*, *through a certain resignation with regard to personal opinions and predilections*—that the favorable dispositions now entertained towards us do not change to the contrary. In my opinion we are really in danger of doing harm to the future by using too amply our liberty in the arbitrariness of personal speculation which now claims prominence in many domains of natural science. In reference to the address of Nägeli I should like to adduce a few practical incidents from the experience of natural science and show how great is the difference between real science—for which alone we can claim the totality of our liberties—and that larger domain which belongs more to speculative expansion, which formulates a series of doctrines which are yet to be proved. There is a limit between this speculative domain and that which is actually proved and perfectly determined. The practical questions lie very near. Whatever is considered to be secured scientific truth demands complete admission into the scientific treasures of the nation. *This the nation must admit as part of itself.* In this lies the double promotion which natural science offers. On the one hand, the material progress made; on the other, the mental importance is similar. Where scientific truth is completely proved every one can convince himself of this truth, and then it will become a part of his thought. Each essentially new truth must necessarily influence the whole method of the conception of man—*the method of thinking.*

By the examinations of the human eye, microscopically and anatomically, we have learned to know its vital qualities and physiological functions; at last, by the discovery of the retina purple, we learn in a perfectly certain manner how the action of light takes place in the interior of the human body, and it is quite an outside organ of the human body, not the brain, but the eye, which experiences this action. We learn that the photographic process is not a mental but a chemical phenomenon, which occurs by the help of certain vital processes, and that in reality we do not see external things, but their images in our eye, and are thus enabled to separate the purely mental part of vision from the purely material. I may therefore say that each true step of progress in natural knowledge produces new conceptions, new trains of thought, and nobody can avoid placing even the highest problems of the mind in a certain relation with natural phenomena.

There is a practical consideration nearer to us. When we consider the educational movements, the question arises—What is to be taught? If natural science demands to be admitted into education, so that its fertile materials may be early inculcated, the question is—What should be the demand? for it is not, as Professor Haeckel says in the matter of descent, a question for the pedagogues; if it be as certain as he thinks, it would force its admission consciously or unconsciously, according to the bias of the teacher. He could not ignore his own knowledge, if, indeed, he did not know where man goes to, he would at least believe he knew certainly, exactly how man had originated, and how in the course of years the progressive series shaped itself, and I should say if he did not demand its admission into the educational series it would be accomplished.

When I promulgated the opinion I held in opposition to the theory of development of organic life then held, that each cell had its origin in another cell, and I still consider it correct, there were not wanting those who extended the doctrine far beyond the limits I intended. I have received the most wonderful theories based on the cellular theory, as that the heavenly bodies represented so many cells flying about universal space, and playing a part similar to that of the cells in our bodies. I do not say they were simpletons, for I gathered that many cultured men had entertained the idea, and could not understand that the heavenly phenomena were based on something else than the utility of the human body. And in order to gain a monistic conception, the idea was arrived at that the heaven must be an organism. I cite this to show how our doctrines are enlarged, and how they may return to us in a form frightful to ourselves. Imagine how the theory of descent may be shaped in the head of a Socialist!

I am not afraid of the charge of *half knowledge*, nor of the inquiry of one of our liberal journals "whether one of the great faults of our time, Socialism, was not based upon the diffusion of half knowledge." All human knowledge is only piece work; we only possess pieces of science, for none here is able to represent each science in the same light. It is exactly because they have developed themselves in a certain one sided direction that we esteem the special scientific men so highly. In other fields we are all in half knowledge, as it were. I have tried to obtain chemical knowledge, but I feel incompetent to sit down at a meeting and discuss modern chemistry in all directions, yet I have progressed so far that a chemical novelty does not strike me as incomprehensible, but I have to learn and relearn. "That which honours me is the *knowledge of my ignorance*." I must do as every one else does who enters the domain of science. The error is in not remembering that it is impossible for any single person to command the totality of all these (scientific) details. We get far enough to know the foundations of natural science. Every time we find a gap in our knowledge we should say, "now we enter a domain quite unknown to us." If every one were sufficiently aware of this he would own it is a dangerous thing to draw conclusions with regard to the history ot all things when he is not even master of the material from which the conclusions are to be drawn.

It is easy to say a cell consists of small particles called plastidules, composed "of carbon, hydrogen, oxygen, nitrogen, and sulphur," endowed with a special soul, the sum of the forces the chemical atoms possess; it is possible but unapproachable for me. Until it be defined, in a manner I can understand, how by the combination of these elements a soul results, I am not justified in introducing the plastidule-soul into the educational programme, or in asking that it be recognised as a scientific truth. Before it can be said this is modern science, it should be completed by a series of investigations, for thus only can the doctrine be confirmed. There are in science many problems which are long in suspense before a true solution can be found. It does not follow that when they are only speculation or presentiment they should be taught as scientific facts. The doctrine of the *contagium animatum* loses itself in the obscurity of the middle ages. In the sixteenth century works exist which place the dogma as a certainty of fact, as now-a-days the plastidule-soul is set up. More than two centuries have passed, and we now find in the nineteenth century some *contagia animata*, bit by bit, but the end of the proof is not yet. Cattle disease and diphtheria are diseases caused by special organisms we know, still we must not say *all* contagia, or even all infectious diseases, are caused by living organisms. The doctrine formulated in the sixteenth century has emerged again and again in the ideas of men, but it is only in the second decade of this century that more positive proofs have been obtained, and it is now only we infer, in the sense of an inductive extension of our knowledge, that all contagia and miasmata are living organisms. Even those who go not so far, have yet said they resemble living beings very closely, and have properties which we know in living beings only; they have waited until proof was afforded, and this caution commands reserve even now.

Science presents a number of facts which teach that similar phenomena can happen in very different ways. When fermentation was reduced to the presence of certain fungi, it was open to imagine all fermentations happen in the same way all those processes included as "catalytic" which occur in the animal body as well as in plants. Digestion, we know, has nothing to do with fungi, although possessing catalytic properties. If the saliva changes starch and dextrine into sugar, when we eat, this new formation takes place; no fungus takes part in this nor in any fermentation in organisms, but there are chemical substances which, much in the same way, as it happens in the interior of the fungus, bring about the chemical change. In the one case the process is connected with a certain vegetable organism, whilst in the other it takes place simply through a liquid. Each single case should be examined, whether the supposition, highly probable, be true, and whether it be justified by facts. Among infectious diseases there is poisoning by snake-bites ; this is compared with those diseases termed infectious (for infection does not signify much else than poisoning) ; after a snake-bite the phenomena which occur might be supposed to be caused by fungi producing the change in the organs, for certain forms of snake poisoning resemble certain forms of septical infections, and yet there is no cause to suspect the importation of fungi, whilst in other cases the importation is recognised and acknowledged.

There are numberless instances in natural science which should constrain us to confine the validity of doctrines to what we can prove, and not by induction to extend it because there is proof in one of several cases. Nowhere is the necessity more expressive than in the field of the theory of evolution.

The question of the first origin of organic beings is extremely old. The old popular doctrine was that things of life could proceed from a clod of clay. The doctrine of *generatio æquivoca* and that of epigenesis are closely connected. With Darwinism the theory of spontaneous generation is taken up ; the idea is very seductive, a series of living forms from the protozoa to the highest organism, and connected with the inorganic world. This is that tendency to generalization which has found place in speculation at all times, and extends even to the most obscure periods. We have the desire not to separate the organic world from the Universe as a something divided from it. In this sense carbon and company has separated itself from ordinary carbon and founded the first plastidule under special circumstances. The beginning of our real knowledge of higher organisms dates from the day when Harvey said *Omne vivum ex ovo*,[1] although incorrect in its generality, for a whole number of generations exist without *ova*. From Harvey to Von Siebold, who obtained the general recognition of parthenogenesis, there lies a whole series of increasing restrictions. It were ingratitude not to acknowledge in the opposition which Harvey assumed against the old *generatio æquivoca* the greatest progress has been made. In the place of a single scheme we have a variety of data, but we have no uniform system which explains, once for all, how a new animal begins.

Generatio æquivoca has many times been refuted, nevertheless it faces us again. No single positive fact is adduced to show it ever occurred. Nevertheless we do *want* to form an idea how the first organic being *could* have originated *by itself*; nothing remains but spontaneous generation. I do not wish to believe a special creation existed. If I want to form a conception in my own way, I must form it in the sense of *generatio æquivoca*, although there is no proof of it. We always have our weapons in ourselves to fight that not justified. To be outspoken, we must own Naturalists have a slight predilection for *generatio æquivoca.* It would be very beautiful if it could be proved. Proofs are still wanting, but if any kind of proof could be successfully given we should acquiesce, but then we should have to continue our investigation, because no one will think that spontaneous generation is valid for the totality of organic beings. All attempts to find a certain basis for *generatio æquivoca* in the lowest forms from the inorganic to the organic world have failed. It is doubly dangerous to demand that this ill-reputed 'doctrine should be adopted as a basis of all conceptions of life. With the Bathybius the hope has again vanished. As to the connection between the organic and inorganic we know nothing. Supposition may be set down as certainty; our problem as a dogma that cannot be admitted. Just as in the progress of the doctrines of evolution it has been found more certain to analyse the original doctrine part by part; we shall have to keep apart the organic and inorganic things in the old way—not prematurely throw them together. Nothing has been more harmful and dangerous to natural science than premature synthesis. Father Oken was damaged in the opinion of his contemporaries and the following generation, because he admitted synthesis to a greater extent than a stricter method would have allowed. We must not forget that every time a doctrine which has assumed the air of a well founded and reliable one, claiming general validity, turns out faulty in its outlines, or is found arbitrary and despotic in essential points, numbers thereby lose their faith in science. "You are not sure your doctrine which is called truth to-day is not a falsehood to-morrow; how then can you demand that your doctrine can become the object of instruction and of the general consciousness?"

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[1] Huxley says he cannot find in Harvey's works the axiom, but the general meaning conveys the idea.

If half knowledge be the characteristic of all naturalists, then in the lateral branches of their science they are only half knowers. If the true naturalist is aware of the limit between his knowledge and his ignorance, he must confine his claims with regard to the public in demanding that only each investigator can designate as reliable truth; that which is confirmed truth only should be admitted into the plan of education. Generally, a distinction alone is made between *objective* and *subjective* knowledge, but there is an intermediate part—*Belief.* It exists in science, with the difference that its application is to other things than religion ; every man instructs himself by means of tradition. The cause in the human mind is a simple one, and carries the method it follows in one domain, finally, into all others. Each creed has its peculiar historical side, and in the garb of an objective fact it appears with certain proofs. This is the case with the Christian,the Mohammedan, with Judaism and Buddhism. On the other side we find subjectivity reigns ; there the individual dreams, there visions come and hallucinations. All this we find in natural science ; there too we have the currents of dogma, there too we have the currents of the objective and subjective doctrines. *First* we try to reduce dogmatic currents. The aim of science has been the conservative side. This side collects the *ascertained facts* with the *full consciousness of proof.* This side adheres to *experiment as the highest expression of proof.* This side in the possession of the scientific treasury, has always grown larger and broader at the expense of the dogmatic stream.

Only thirty years ago the Hippocratic method of medicine was spoken of as something sublime ; it is now annihilated nearly down to the root. During the last seventy years the science has undergone a complete reformation, and at the end of the present century the objective current will probably have consumed the dogmatic one. In this science, any one who *wants* to speculate, plenty of opportunity is offered. I do not go so far as to make "the inhuman demand," that every one is to express himself entirely without any subjective vein, but I do say, we must teach a knowledge of facts in the first place, and if we go further must say, "This is not proved, but this is *my* opinion, *my* idea, *my* theory, *my* speculation." This we can do only with those who are educated and developed. We cannot carry the same method into elementary schools, and say to each peasant boy, "This is a fact, that we know and that we only suppose." On the contrary, that which is only known and that which is only supposed, as a rule, get so thoroughly mixed that the supposed becomes the main thing, and the really known appears of secondary importance. We cannot give facts only, they must be arranged in systematic order.

Professor Nägeli has discussed in a philosophical manner the difficult questions he has chosen, but he has taken a step extremely dangerous. He has done in another direction what in one way is done by the *generatio æquivoca.* He asks that the mental domain shall be extended, not only from animals to plants, but finally that we shall actually pass from the organic world into the inorganic with our conceptions of the nature of mental phenomena. All this may be very fine and excellent, and may after all be quite true. *It may be.* Is there any scientific necessity to extend the domain of mental phenomena beyond the circle of those bodies in which we see them really acting? I have no objection that carbon atoms should have a mind, or that they obtain a mind in their union in the plastidule association. *I do not know in what I am to recognise this.* It is playing with words. If attraction and repulsion are declared to be mental occurrences, *then mind ceases to be mind.* The human mind may eventually be explained in a chemical way, but it is not our task to mix these domains. We shall not advance unless we limit the domain of *mental phenomena to where we perceive it.* We are not to *suppose* mental phenomena *where perhaps they may be*, although we do not notice them *perceptibly.* There is no doubt the whole sum of mental phenomena is attached to certain animals, not to the totality of organised beings, not even to all animals generally. I admit that certain gradual transitions, certain points can be found, where from mental phenomena we get to phenomena of a simply material or physical nature. I do not declare that it will never be possible to bring psychical phenomena into immediate connection with physical ones, but I say *at present we are not justified in settling down this possible connection as a scientific doctrine.* We must distinguish between what we want to teach and what we want to investigate.

At this moment there are few naturalists who are not of opinion that man is allied to the rest of the animal world. Vogt is of opinion that a connection will be found, if indeed not with apes, then perhaps in some other direction. I should not be alarmed if proof were found *that the ancestors of man were vertebrated animals.* I work by preference in the field of anthropology, *yet I must declare that every step of positive progress which we have made in the domain of prehistoric anthropology has really moved further away from the proof of this connection.* Cuvier maintained in the quaternary period man did not exist; but now quaternary man is a real doctrine, tertiary man a problem, and yet there are questions in discussion for the existence of man during the tertiary period. Even ecclesiastics admit, as Bourgeois, that man existed in the tertiary period. Quaternary fossil man we find just the same as ourselves. Only ten years ago, when a skull was found in peat, or in the lake dwellings, a wild and undeveloped state was seen in it. We were *then scenting monkey air*, but these old troglodytes turn out to be quite respectable society. Our French neighbours warn us not to count too much on these big heads; it may be possible the old brains had more intermediary tissue than those of the now day, and that their nerve substance, notwithstanding the size of the receptacle, remained at a low state of development. Comparing the total of fossil man found with the existing types, *we find that in the present there is relatively a much larger number of lower types than there were in that period. In the fossil types the lower developments are absolutely wanting.* That only the higher geniuses of the quaternary period were preserved I dare not suppose, but this can be said, that one fossil monkey skull or ape-man has never been found. It is possible in some special spot on earth tertiary man lived, for the remarkable discovery of the fossil ancestors of the horse in America, from which the horse had entirely disappeared, gives countenance to the idea. It may be that tertiary man has existed in Greenland or Lemuria and will be brought to light somewhere or other. *We cannot teach, we cannot designate it as a revelation of science, that man descends from the ape, or any other animal.* Bacon said, with perfect truth, "*scientia est potentia*" (knowledge is power), but the knowledge he meant was not speculative, not the knowledge of problems, but the objective knowledge of facts. We should abuse and endanger our power if in our teaching *we do not* fall back upon this perfectly justified, perfectly safe, and impregnable domain.

The lectures concluded, I now advert to Haeckel's theory of the ancestral ape. The variations of the human form can be perpetuated as six-toed and six-fingered, or spotted, or warted, &c. (*Vide Lawrence's Lec.*, vol. ii, p. 178), and by interpropagation such types may become heritable. If we carry the idea backward to the descent of man, what have we? By the doctrine of evolution the animal which emerged from the animal is man,[1] tailless or hairless—articulated speech, or brain power, or whatever be the differentiation—he is alone, and propagated his variety through the stock from which he originated. The variation eventuates in a species, association producing culture through the communication of ideas. If this variation occurred only once it is sufficient to account for all the races of man by the perpetuation of particular organized forms, or faculties. Some of the progeny would probably revert to the

[1] Organic man has a similarity to other animals; there is the same necessity for air, food, and sleep, digestion does not materially differ, the nutriments are converted into blood and distributed by the arteries and veins through the system, the absorbents extracting and appropriating to each part those ingredients adapted to their uses; the parts of the body and modes of growth; the bone, muscle, tendon, skin, hair, and brain, scarcely differ in their physical and chemical characters; the secretions, as bile, tears, saliva; the senses exhibited through similar organs, modified in species; emotions, passions, and propensities, are manifested in the same way. Man divested of intelligence would be below the brute in instinctive capacity and modes of defence and offence, and even "that instrument of instruments," the human hand, would aid but little without intelligence to direct its movements, nor physically speaking would intelligence aid much unless the hand was present to be directed (*Kidd, Bridg. Treat.*). Organic man exceeds all animals through possessing the hand, Intellectual man by possessing abstract mind.

ancestral type, some might inherit the form of both parents, others that of the more perfect organism. It is not to be supposed that one step produced the whole of the changes. Variations may be progressive and retrogressive and even the perfected type, in the earlier variations, may have reverted to a type representing a degree in advance of the ancestral organism, but failing in the higher definition which constitutes man; thus might be perpetuated an animal form of advanced structure. It is as easy to conceive the anthropoid apes were the abortive descendants of early man, as to suppose the ape was the direct ancestor of man, probably they were a distinct variation. In either case we should have the vertebrated, erect and placental mammal, class *homo*. The brain of the ourang is that of a child in its earliest form, and as such it remains in the quadrumana [1] (arrested development, or the earlier brain-type—the assumption *may be* of either). It is in perfect consonance with the needs of the creature, thus would be an argument against arrested development; it is inst~~ru~~inctive, impulsive, but not inventive, and fails in the constructive powers of the lowest classes. Huxley has shown there are essential differences in teeth and structure between man and the ape. It seems rash to assume that *because the ape occurs in the same natural class as man that therefore he is man's ancestor, or a descendant from man*; the original stock had probably diverging branches.[2]

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[1] Nature never elevates the brain of an individual of a lower to that of a higher class: though the brain of an individual of a higher is frequently not developed beyond the degree of the lower, (*Kidd. Brid. Treat.*, p. 52.) The size of the brain does not appear to be connected with the dispositions or qualities of animals, for most opposites as to disposition may class in reference to size as the tiger and deer, the hawk and pigeon. The proportional size of the brain with reference to size of body gives a more uniform result; thus a crocodile 12 feet, a serpent 18 feet, a turtle from three to five hundred weight, have their brain substance of half an ounce, whilst that of a sparrow in proportion is bigger than that of a man (*ib.* p. 58). The true criterion appears to be the convolutions on its surface. Peschel says of the ape, "the brain of a child with the jaws of an ox" (*The Races of Man*, p. 4).

All birds which use their claws as hands, as the hawk, parrot, and cuckoo appear more docile and intelligent. The gregarious tribes have more of acquired knowledge (*Zoonomia*, vol. i, p. 199).

[2] Apes always tread either on the outer edges of their soles . . . . or on the backs of their bent finger-joints. Man in contrast with the ape stands, walks, jumps, dances, climbs, swims, rides, sits and can remain for a long time in an independent position." "Although the dentition of man and the apes of the old world is very similar, differences occur; the permanent canine tooth is developed in us before the last molar teeth, the front before the back; in the apes on the contrary, the development of the canine teeth forms the conclusion of dentition and the second back molar teeth appear before the front ones. Finally the early disappearance of the *inter-maxillary* bone in the human infant may be cited as a distinction." "At the time of birth the gap between the child and the young of the ape is very narrow . . . . the brains of children and young apes approach very closely in size, but of all parts of the body the brain of the ape grows least, and although the brain of the anthropomorphous ape contains all the main parts of the human skull, its development nevertheless assumes quite another direction. . . . . Before the

If we run through the characteristics of the races of man we find variations minute in degree but with such marked differences, that some one (probably Vogt) said if naturalists were considering any other creatures than man they would pronounce them to be of distinct species. We know not what was the origin of man, all rests in hypothesis, but we may assume that as development is the order of nature, that by differentiation, however induced, the witless Vedda may become the parent of a highly gifted intellectual race; as the bow-shanked, coloured negro, by a succession of judicious crossings becomes the straight-limbed white-skinned Caucassian. We judge only by that we find. Race may merge into race as animals into species, but we miss the intermediate links. In this view the races of man may have originated from a single pair, or more probably from an individual. This is supposing that the variation occurred but once; but for such an assumption there appears no warranty. Thus by generation through a lower grade Man and the Gorilla may be the offspring of the same parental stock differentiated in structure and intelligence. We have not a few thousand years only to work these changes, but æons on æons.

CHAP. III.

Hypothes~~i~~es and Philosophies.

In nature we have everywhere unconscious selection,[1] as we have chemistry by affinities. As a mechanical illustration there are the dunes heaped on the shore on parts of the Bay of Biscay by the force of the wind and waves, and so it may be natural selection acts by an amalgamation and differentiation of

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change of teeth has begun, the brain of the ape has usually attained its completion, whereas in the child its proper development is just then actively beginning. Their development is directed to different ends, and the longer they advance towards these ends the greater are the contrasts, (*Peschel*, *Races of Man*, p. 3, 4.)

The assertion that there has been a tailed race of man, defended by Monboddo, Lawrence shows to be a pure fiction (*Lectures*, vol, ii. p. 160). In his lecture on the erect attitude peculiar to man, he enumerates the distinctions between the bones of men and animals, (*ib.* p. 118, *et seq.*) In proof of the distinction between men and all other animals, he says "no animal except man . . . . could support the body *in equilibrio* on one foot only" (*ib.* p. 145) and no other animal has buttocks.

[1] "Every gland seems to be influenced to separate from the blood or to absorb from the cavities of the body, or from the atmosphere its appropriated fluid by the stimulus of that fluid on the living gland: and not by mechanical or chemical absorption. Hence it appears that each of these glands has a peculiar organ to perceive these irritations" but which are not "succeeded by sensation" (*Zoonomia*, vol. i, p. 173).

properties in assorting the races of man; a given end arising from a given direction through the impulsion of nature's law. I cannot suppose a creation according with the orthodox idea, for if we imagine a Creator, when in idea we view the vastness of the universe it is impossible to suppose each detail arose from a personal superintendence, but that the presence of the Creator is expressed in His fiat, the governing law. The intelligence which could conceive creation, could consummate its purpose by the interposition of law, as an antecedent, by which all natural facts became creative conceptions.

In the face of what Virchow has told us it will be useful to examine that which Huxley urges:

> "Let us suppose we do know more of cause and effect than a certain order of succession among facts and that we have a knowledge of the necessity of that succession and hence of necessary laws—and I for my part do not see the escape there is from utter materialism and necessitarianism" (L. S., 141).[1]

Necessary laws imply a law giver; how such a presentment can lead to "materialism" is not clear, the law is its own fact, hence as the cause of the fact, a manifestation of intelligence. What can materialism have to do with the disposition of facts, from other than material agencies? unless it be *proved* that matter *institutes* law and thus *creates* its facts. When it can be shown that accident can be universal in its effects and produce invariable order and a homogeneity in facts, it will be time enough to say that it is impossible "to demonstrate that any given phenomenon is not the effect of a material cause,[2]

> *It may be true* "that any one who is acquainted with the history of science will admit that its progress has in all ages meant and now more than ever means, the extension of the province of what we call matter and causation, and the concomitant gradual banishment from all regions of human thought of what we call spirit and spontaneity." (*ib.*)

When the new philosophy can show what mind, heat, consciousness, intelligence, and life are, it were time to present such a dogma. To say they are the result of the molecular changes of matter is an unevidenced assumption. We know "that every future grows out of past and present," but whether the finity of man will attain to a knowledge commensurate with material facts as expressed "in feeling and action" is doubtful. Nägeli infers such a possibility; Du Bois Reymond and Virchow emphatically say no. Thinkers may deplore, but need not dread the "progress of materialism." Whatever the "advancing tide of matter" may do, it certainly cannot be said to tend to the advantage of or to "the increase of wisdom." Were the new philosophy founded on evidence and experiment it probably would produce a *new era*; but as the facts stand, the want of knowledge is made up by confident surmises; there is no need to dread that thinking men will fall down "in terror before the hideous idols" our professors have reared. No one, unless a bigot, fears a true interpretation of the laws of nature;[1] but every thinking mind must despise all phases of dogma, and when we meet with scientific dogmas they are simply ridiculous, being subversions of the fundamental bases of science.

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[1] "To call life the property of organization would be unmeaning; it would be nonsense" (*Lawrence's Lec.*, vol. 1, p. 73).

[2] Ray, speaking of first breathing, quaintly says, "Here methinks appears a necessity of bringing in the agency of some superintendent intelligent being, for what else should put the diaphragm and the muscles, serving respiration, in motion all of a sudden, as soon as ever the fœtus is brought forth? Why should they not have rested as well as they did in the womb? What aileth them that they must needs bestir themselves to get in air to maintain the creature's life? Why could they not patiently suffer to die? You will say the spirits do at this time flow to the organs of respiration and the other muscles which concur to that action and move them. But what raises the spirits which were quiescent, &c., I am not subtle enough to discover. (*Wisdom of God manifested in the works of creation*).

The advice is sage that we should not "trouble ourselves about matters of which . . . . we can know nothing" ('L. S.'), although the observation is addressed to Theology it abates nothing of its pertinence when applied to supposititious Science.

What molecular hypothesis of mind can account for the incident mentioned by Meadows Taylor ('Story of my Life')?[2] No material theory of mind can claim such an incident, nor charlatanry and trick on which Carpenter *is so logical* and Hammond assumes to be *so scientific*. The incident shows the impossibility of the material hypothesis of mind; if there be a rule, the rule would account for all its facts.

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[1] Whewell inquires—Is it by chance that the air and the ear exist together? Did the air produce the organization of the ear? Or the ear independently organized anticipate the constitution of the atmosphere? Or is it . . . . that there is a mutual adaptation produced by an intelligence acquainted with the properties of both, and adjusted them to each other (*B. T.*, p. 123).

[2] Lying in his cot, fatigued, sleep being impossible from noises without, his tent doo r open, there he saw a figure in a wedding dress which held out her arms to him, and said, "Do not let me go," he sprang from his couch. As he advanced the figure receded until it vanished (vol. 2, p. 32.) What is the solution, preoccupation of mind? Probably, but no molecular brain change could present such an object. He also relates (vol. 2, p. 294 :—Captain——, the senior officer of the 74th Highlanders, was in his tent writing letters, the side wall of the tent being open, where a young man in hospital dress appeared without cap, and without saluting said: "I wish, sir, you would kindly have my arrears of pay sent to my mother, who lives at ——." The captain took down the address and said, "All right, my man, that will do." When the figure was gone, the irregularity of the whole affair struck him; he sent for the sergeant and inquired why he permitted "—— to come to him in that irregular manner." Appearing thunderstruck, the sergeant said, "Sir, do you not remember he died yesterday in hospital, and was buried this morning." The captain showed the address he had taken down. The sergeant then stated the kit had been sold, but there was no entry in the company's register, so he did not know where to send the money. The general registry of the regiment was searched and the address given by the appearance proved to be correct.

We are told "that the order of nature is ascertainable by our faculties to an extent practically unlimited;" "our volition counts for something as a condition of the course of events;" and that "each of these beliefs can be verified as often as we like." If the human faculties have power to an unlimited extent to ascertain "the order of nature," why should there ever be a question on its phenomena? and if "the volition" of man be alone molecular change, how is it possible it can account for anything, even though it be "a condition in the course of events?" If it arises from an accident of matter it has but the faculty of its origin, and if it be impelled by an "iron law," what can the will have to do with any "condition" occurring in the course of events? Yet these conditions can be experimentally "verified;" How? Can our unlimited faculties experimentally show what the mind is, its connection with matter, and its springs of action?

When it is said—"If there is one thing clear about modern science it is the tendency to reduce all scientific problems, excepting those which are purely mathematical,[1] to questions of molecular physics, that is to say to attractions and repulsions, motions and co-ordinations of the ultimate particles of matter."

It had been well had we been told what these ultimate particles of matter are. Attractions, repulsions, and motions, are not objective things; and when "we know nothing, can know nothing of matter," by what are we to recognise these ultimate particles? If we are to understand they are the objective presentment of an Infinite idea,[2] it is easy to conceive that everything can then be, and there is no more to say; but if, on the other hand, the intention be to express they are material substances out of which intellect emerged, it is not a very consecutive logic to except mathematics, purely a child of the intellect, and yet subject intellect to the trammels of matter. We may have another mode of escape—"the language of science" being "materialistic," the language and not its substance is involved, and "the molecular changes" so much dwelt upon, may after all be intended to mean creative and life impulses. Each thinker thinks for himself; the irrefragable laws of nature controlling matter, and presenting intelligence, continue their courses irrespective of the hypotheses, suppositions, and dogmas of our "unlimited faculties" (finalities). We are compelled to be content with the scattered pebbles by the wayside as our insight into that which is, and that which will be.

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[1] The difficulties which appear to reside in numbers and magnitudes arise by measuring with our own sounding line—the greatness is no quality of numbers, all that belongs to number, space, and ratio is equally true of the largest and smallest—and have ~~relatives~~ to our own faculties (*vide Whewell, B. T.*, p. 277.) reference n.c.

[2] God, however "unknowable," is consistent with all the facts we know, hence there is a consequence even in an idealization.

No assumptions or presumptions of new philosophies, nor old ones, can make *the cause* and its effects other than they are.

More than half the difficulties and obscurities of modern science arise from the affectation of professors using the materialistic terminology, as if they supposed the phrases could become evidences. These terminologies have become necessities for the material philosophy, because they give a *mechanical* expression to the subjects in comment. Tyndall, when lecturing on Fermentation at Glasgow, describing the effect of "the bacteria," says, "they exercise a useful and valuable function as the *burners and consumers* of dead matter." Anything more misleading (presuming science to be intended) than such phraseology can scarcely be conceived. The bacteria neither burn nor consume the dead matter, but, in accordance with their special place in nature, change the character of the substances which the living energy has for the time deserted (latent). They complete the office the *vibrio* had commenced; both are the agents of a *chemical* transmutation whereby the used substances are reconverted into their elemental states, to reappear and work out the purposes of nature.

Lecture-room verbiage makes nature to appear as a series of catastrophisms; as if quiet events were brought about and accompanied by violent commotions. Who would conceive two portions of oxygen and one of carbon combined in orderly affinities to form dioxide of carbon? No, we have the oxygen atoms, like highwaymen lying in wait, to seize on and misuse their fellow congener, and convert his properties to their use. When we breathe we have burnings and combustings, &c. (*vide Physiography*, 227). Nervous persons might expect at any moment, without premonition, that their bodies, by a spontaneous explosion, might be strewn over the room. The silence of order is disturbed by rushings and crushings, collidings and oscillations, as though elemental substances were not orderly and homogeneous, and did not cohere in affinities, excluding the surplus heat which prevents their more intimate union. These crushings and rushings even accompany the snow-flake when it sends forth its images with gentlest touch. From the description, we might prepare to meet the crushing march of the glacier, and even in the commonest facts expect the disastrous rush of the electric fluid, and when atoms meet the detonating crash of the thunder. Such grandiloquous phraseology may excite the wonder of the ignorant, amuse the idle, and instruct no one. Such absurdities do not depict true science, are not good taste, nor do they describe the workings of nature. As a general principle, *tall talk* only more emphatically displays paucity of ideas and want of knowledge; it may be endured from those who by real knowledge occupy a deserved place in the scientific arena, but is execrable in imitators. There *is no rhythmic ring* in it, although now-a-days we have "rhythmic adjustments" and even "the rhythmic march of the molecules."

Gases in nature, whatever their weight, intermingle in accordance with their specific gravities. The denser permeate the lighter and the lighter descend into the denser. The explanation probably is that the denser gases unimpededly occupy the interstices between the particles of the lighter, and again these the particles of the denser (*Le Sage's idea of gravitation*). Experiment shows a cubic foot of steam, alcoholic vapour, and ether vapour, will each fill a vase containing a cubic foot, and that the three together will occupy only a similar vase without chemically intermixing—the temperature of all being equal, and so maintained. In their liquid form, as water, spirit, and ether, the result is not obtained (*Cooke*). Recent science generally affirms the formation of water to be a chemical, but air a mechanical result[1]. What are we to understand, that electricity combines the hydrogen and oxygen of the water, but that the oxygen and nitrogen are united by pressure into particles of air, or that they merely lie together as the steam, the alcoholic and ether vapours do in the vase?[2] The components of air neutralize each other, and therefore must be supposed to form a compound or new substance. We cannot pick the nitrogenous particle from the air, nor that of the hydrogen from the water, unless by art. The gases of water and air combine equally by their affinities; if it were not so, how are the proportions of either formed?—water in weight 8 to 1, air in parts 23 to 77. Air may be called *mixed*, and so it is pronounced to be, but why the admixture is called *mechanical* is not clear, were it so, the gases would be in strata unequalized as to quantity and quality. Oxygen acting alone would bring death as surely as would the nitrogen alone, the former from its vividness and the latter from its inertness of action. Crystallization may be a mechanical combination because it is formed by layers. The substance, air, is invisible, besides nitrogen and oxygen there may be aquafortis (nitric acid), ammonia, sulphuretted hydrogen, carbonic acid, and other substances; are all combinations of air, or do they only float in the atmosphere? Dissimilar substances float in water; they are not said to be component parts of water. To call air a mechanical arrangement does not subvert its nature any more than if water was said to be a mechanical composition. In the sea water we have a something more than oxygen and hydrogen. Where are we to find a separate chemistry and mechanics for air and water when the elements of both can be presented in a liquid form? Electrical force will disentangle oxygen from nitrogen and oxygen from hydrogen. The disentangled oxygen of air combining with the hydrogen floating in the atmosphere falls as rain;[1] the oxygen is not *consumed* (*Mackay's Physiography*), there is merely a change by affinities. The chemistry and mechanics of nature never consume or destroy, they only institute changes.

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[1] "The atmosphere is essentially composed of one volume of oxygen and four of azote (nitrogen), and *is at least constituted upon strictly chemical principles,*" and "may be considered to be as much a chemical compound as water (Prout, in *Bridgewater Treatise*, p. 100).

[2] Substances may frequently be expressed in ~~their~~ three modes, as by the atom, the weight, and the volume (*e.g.*), water by the atom, is one of oxygen to one of hydrogen; by weight, one of hydrogen to eight of oxygen; by volume, two of hydrogen to one of oxygen. These seeming differences are reconciled by the statement that an atom of oxygen is eight times as heavy as that of hydrogen, but only half the size (*Draper's Chemistry*, p. 153).

All the components of the protoplasm are of air, or float in the air in its generic phase of atmosphere, and through heat, by the agency of the great cosmic might of vitality, are congealed into substances. Mediately vital force is the great mechanician and chemist of nature, the conservative power which makes all the sequences of natural facts possible.

The germ theory of disease illustrates the hypothesis of the spontaneity of life, presenting a condition of things always awaiting vitalization. It appears equally unscientific to present the germs as active living substances as to present them as *dead* germs awaiting animation. We have the perplexed question of the rotifers over again.[2] If we assume the spontaneity of life to be the fruition of the cause, we can then say that the vesicle to support life is always present, and when conditions are suitable the life becomes apparent or active. In the axioms

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[1] "The properties of water, with regard to heat, make one vast *watering engine* of the atmosphere" (*B. T.*, *Whewell*, p. 95.)

[2] So far was the idea of resuscitation carried that Spallanzani insisted that mummies could be revivified, yet appears to have doubted. He says: "An animal which revives after death, and revives as often as one will, is a phenomenon so unheard of that it appears improbable and paradoxical, it confuses all our ideas of animal life." Three classes of animalcula, the *Rotifera*, the *Tardigrades*, and *Anguillulæ*, were supposed to be indestructible, because in a dry state they appear to be dead, but revive by moisture; when they are really dry they never recover. Pouchet proved this in his experiments on the Rotifera, Tinel on the Tardigrades, and Pennetier on the Anguillulæ. Ehrenberg and Diesing nullified the hypothesis of the resurrectionists. The former said: "They only resuscitate animals which are not dead." The resistance of the Rotifera to cold is marvellous, "the lowest temperature we can obtain in our laboratories does not seem to have any effect on them" (*L'Univers*). Pouchet says: "I have removed them quickly from a freezing apparatus and thrown them into a stove heated to 176° Fahr. When they emerged, on being immersed in water they were seen to recover their animation and run about full of life" (*ib.*)

"*omne vivum ex ovo*" and "*omne vivum ex vivo*" we find the genesis and continuance of life, the commencing fact is the continuing fact, the life from the egg and the egg from the life, exactly what Koch found when watching the *Bacillus anthracis*, the cause of splenic fever. The creature burst and strings of spores were exposed as Dallinger and Drysdale found, who watched for a weary time other forms of the same species, the free-swimming spot, split up into germs or spores. These spores are the life-bearers, not the life, *that* arises from conditions. As the ova is fructified by the sperm in animal organizations, so the germs entering a wound find there the suitable condition or fructifying element inducing erysipelas. In small-pox the germ is in the lymph; no one would say the lymph or the dried coagulated blood of the splenic disease were substances active with life, though the blood-dust kept by Koch for years produced the disease. Grove, of Wandsworth, first called attention to the germ theory of disease (1842). His treatise was a great advance on the ideas then held by the medical profession, and may be considered to be the nucleus of its present development; in principle there does not appear to be much advance. Lister's idea carried into practice has been found to be efficacious; destroy the spore, or make the condition for its fructification impossible, and there would be no life (*i. e.*, no disease), is exactly what occurs in all the experiments by which it is attempted to show that there is no spontaneous life—in fact, exactly what Liebig did when he destroyed the torula cells (yeast) to disprove their fermenting power, and as others do when they boil their compounds. Heat will kill the bacteria, cold will numb them, but neither heat nor cold will kill the spores unless the operations are continuously repeated. Stop a man's breath and his life is soon extinct; boil a lobster and it blushes in death; deprive the germ of its nitrogenous compound, air, and the life cannot be; the natural condition is wanting. If the air be laden with life-vesicles or germs there can be no doubt life is spontaneous, and the substances of the protoplasm form in the atmosphere so as to produce varied and different results. All of living nature inhale these germs, which in their new habitations find the conditions for their exhibition as a living thing, or as contributing to the continuation of the living thing.[1] Diseases may be communicated by inhalation as well as by contact.

Burdon Sanderson, who passed the whole facts in review, comes to the conclusion that the "*contagium vivum*" exists in two distinct forms, "the one fugitive and visible, as transparent rods, the other *permanent and latent*," *but imperceptible and not yet presented in the field of the lens.* Richardson, on the other hand, in what he calls "the Glandular Theory," in effect says, "The base of the poisonous matters of communicable disease I call septine, and it is the product of the secretions of the animal body, which contain and yield an organic product, as a gastric secretion, pepsine, a salivary secretion, ptyaline, and so on; each of which has a different function although their bases have the same organic construction. Diseases are thus of a glandular origin, and the poisons producing them modified forms of one or other of the secretions. Each poison is specific and the parent of the same disease through endless time. The type of all being the snake virus, and as an example, he gives that of hospital fever, the poison of which, after evaporation and pulverization, strongly resembles that of the snake. In the dry powdered state they are inert, but will, when kept for long periods, absorb water, when their activity is revived, but excessive dilution will destroy their life-principle, as proved by Fordyce (vaccine lymph), as also will heat, oxidising, and other agents—but cold is a preservative. It is an error to suppose these poisons are propagated by germs, the multiplication occurring by changing the secretions and the albuminous substance of that with which the virus comes in contact, the change being catalytic. The mode of the introduction may be by swallowing, or by contact, and may enter the system as dust, fluid, or vapour. The diseases are "distinctly the offsprings of living animals," *i.e.* they are parasitical, and can be communicated to other bodies. As a rule, "the human body furnishes all the poisons that the human body suffers from—that is to say, there is a progression of poisons from one body to another, and that ordinary secretions may change and become poisonous without previous infection. These illustrations present the general principles of the theory of infectious diseases.[1]

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[1] Bell says: "It is just to say that all animals consist of the same chemical elements"—and perform their functions "by the same vital actions" (*B. T.*, p. 126).

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[1] A series of experiments on sewage and ammonia appears more or less remotely to have a bearing on the germ theory of disease. Schliessing and Muntz filled a long glass tube with sand and limestone heated to redness. When cold a stream of liquid sewage was run through it; the percolation occupied eight days, for eight days after no nitrifaction took place, the ammonia in the liquid being merely that contained in the sewage. After eight days small quantities of nitre were found, gradually the quantity increased, at length no trace of ammonia existed in the fluid. The only explanation appears to be fermentation. The experiment was repeated by filling the tube with vapour of chloroform, and whilst it was present no nitre was discoverable. On its removal (after fifteen days) a month elapsed before nitrifaction began. The experiments showed that the presence of the vapour of carbolic acid has a marked power of stopping the formation of nitric acid, bnt the presence of bi-sulphide of carbon and of chloroform stops the whole process.

Warrington experimented on four vessels containing solution of *chloride of ammonium* with a little acid *phosphate of potassium.* Two were sown with earth from a fairy ring (containing decaying fungi); one bottle containing the earth and one the solution only were put in the dark, the two others kept in the light. At the end of three months the bottle sown with the earth kept in the dark, contained an abundance of nitric acid, but no ammonia, the other three, ammonia but no trace of nitric acid. A small quantity from the seeded bottle was added to the two unseeded bottles, one of which was kept in the light, the other in the dark, in a month that only kept in the dark contained nitric acid. The whole process appears to be analogous to that by which the alcohol of wine is converted into acetic acid (*vide Chem. News*, Dec. 14, 1877).

If the theory to which the experiments point be established, it probably will have an important bearing on the germ theory of disease. If the nitrogen, a necessity of the germ, is not present as nitrogen, it is clear the germ is not formed, so there can be no potence of life. It may also throw some light on the formation of the "atmospheric germs." The atmosphere containing all the ingredients necessary for

The one system calls the introduced substance a germ, which multiplies by propagating itself and converts a healthy into a diseased state; the other, by a virus introduced through the absorbents or it may be inbred, and by a catalytic process acts noxiously on the secretions. The former makes the germ foreign to the body infected; the latter is an animal product bred by an animal, and communicable, or bred by the body in which the disease occurs. It is difficult to discriminate between the two; that of Sanderson appears as a conditional spontaneity; that of Richardson as a poison acting on present living substance, or inbred by it. Practically the effect is the same; in the sequel both are blood-poisoning.

The germ theory of disease, with its imperceptible living or "atmospheric" germs, is something like talking about the beginning of creation.[1] The beginning is always a beginning in the continuity of its fact, for a law once in being is always existing; that which originated life on earth is in continuous action. There is no law for a particular purpose, it is one continual law *conditioned to its purpose* and as to that particular purpose unchanging. These conditions in infinite variation produce that chain of effects we term phenomena. We talk of eternity *as if it were* only a possibility. Eternity is always eternity, nor beginning nor end; the beginning was eternity and eternity the totality; the past, the present and that to come, have but one aspect, being synchronous in action; we cannot think of the present but *it is* the past and *is* the future.

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the formation of the protoplasmic compound. Assuming they are at first partially compounded and chemically amalgamated through affinities on contact, innocuous as air, but poisonous by imbibition in the blood, setting up an abnormal state inducing disease—sowing the blood with poisonous matter in the same way as in the latter experiment Warrington sowed the ammoniacal solution. These experiments appear to confirm Richardson, and more so when we consider that the elements, by themselves, of the most important of natural combinations, may be said to be poisonous, as singly, being unable to support life. In air—oxygen and nitrogen there is too great an activity, corrected by a too great inertness. Water—oxygen and hydrogen (a metallic oxide, *Dumas*)—neither life supporters, and Salt, chlorine and sodium, both poisons in their pure state. Yet these inorganic substances in combination are life-bearers and necessities of nature. Probably, this is the state of the floating germs which induce disease—germs differ as much as animal tissues differ. Taking the isomeric compounds as examples, the animal and human tissues, however apparently identical in form and in their microscopic appearance, by a particular combination of the particles widely differ in results (the blood-corpuscules of some animals differ widely from others). Assuming vitality as the principle of nature, the variations in animation in the first instance are probably due to particular chemical amalgamations, and the life once established is perpetuated by multiplication, differentiated by additions imbibed from the environments, and again differentiated by a new admixture of the particles composing the organism; hence as are conditions so may the germ be innoxious or noxious.

[1] "The short progressive changes from the lowest to the highest state of existence of organization and enjoyment point to a beginning." (Bell, *Brid. Treat.*, 223.)

In time there can be no beginning or end, it is eternity. The practical application of time is a finite distinction ; there is the past, the present, and the to come, but in infinitude all is a continuing present. We talk of space and the centre of the universe as though all intelligence were concentrated in earth, and the ideas man conceives were the rule of the universe. Such finiteness of conception led to the assumption that the world comprised the universe and that the sun swung in the firmament but as its attendant. The *sun* of science, the regenerator, *almost creator*, is but an attendant mote in the throng of suns which pulsate in space. Man standing in his place on the earth, had he a microscopic vision would find himself on the apex of a hill, with declinations on every side. If he were removed to the most distant star art discloses, he would still be in the centre of the universe, around and beyond he would have the same vision of astral systems, and if then removed to the remotest of them, he would have a similar horizon, bounded only by shining suns and whirring worlds. We talk of space and pursue the idea until we come to the ridiculous conception of a thing bounded by itself. What is space ? a finite idea, a way mark of limitation.[1] The same character of limitation occurs when we attempt a conception of the Creator. Is it because we cannot conceive a space unlimited, and a Creator unshackled and of boundless power that it is to be said intelligence is the mere vibrations of material particles, not those of a glorious sun, or of an ethereal world, but those of a diminutive speck, a particle of creation ? Is it because the illimitable and the infinite is incomprehensible to the finite, that we are to bound the boundless and make the Creator, or cause an emanation from created and moulded substance ?—OMNIPOTENT INTELLIGENCE *the mode of the thing !*—The law of the substance is the antecedent of the substance, but in the beyond we have in the antecedent of the law, the power by which it was evolved. We are amazed at the science which brings the stars within our reach, and speaks confidently of the substance of suns. What is this wondrous science but the link chain of the infinitessimal ? We know the method, but we do not know the fact of the method. The sum of knowledge, even could "all the finite" be mastered, compared with that beyond, is like the dancing mote which reflects the point of light striking it,—only brilliant by a borrowed influence. Our powers are finite, we think the finite ; "human intelligence shines so mere a speck amid the abyss of the unknown and the unfathomable." We may gather shells on the ever recurring shore of the vast ocean of eternity, and when some glitter more brightly than others, the aspiring, in their assumption, may say with Nägeli, "we know and we shall know," but the thoughtful, in the sadness of disappointment, with Du Bois Reymond will confess: "*ignoramus ignorabimus.*"

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[1] Nägeli has the same idea, the text was written before Nägeli's address was delivered.

Things are only equal to themselves and relative to all else. A pound of water produces a pound of steam—the force expressed by raised temperature. The heat imponderable in the vapour, is external to the substance on which it acts, the motion being *in*, not *of the* fluid. If heat be only vibration, or wave motion, whence the power that caused the vibration?[1] The steam in a receiver reverts back to water—its expansive power apparently exhausted; repeat the process and we have the same result, a bristling energy; unconfined it passes into the air, an *imponderable* vapour, and its elements combine in other affinities.

The ponderosity of steam is expressed, because of its elemental form, as it is possible to make a sum of its particles. Heat alters the relation of the particles; experience alone teaches us, whereby *we know* steam will revert to water. Surely we cannot say the *quality* which caused this change, the *quantity* of which can be measured, although imponderable, is a vibration; if a vibration, of what? if of the water, it is due to the excitation; then due to a something, although weightless, yet impulsive as a force. Weight is but the expression of a force, the gravitating power, and if gravitation (*vide* note 1, p. 46) be correlated with the other forces then heat has weight in its expression as gravity. All the forces in the view of science are vibrations, but if correlated with gravity, force becomes the expression of weight. There is no distinction in effect between the pressure of bulk (as a grain, a cwt., or a ton) and the pressure induced by the action of force, as for instance the hydraulic press. The forces can be tested by the weigh beam; because not objective substances, is it to be said that they are but the vibrations in the substance which shows their presence as effects? Weight, like other terms of the finite, is but a relative expression. If gravitation be correlated with the other forces the difficulty, whether heat be a substance or a vibration, vanishes. Weight then becomes the expression of a principle: Force (impulsion and weight). If heat has the power to change the relations of substances, it has quality, and if the quality be measurable it has quantity, and, more, it has objectivity. All combustion is due to heat; if heat be only a vibration why does it consume the substance in which it acts? If alone the "*vis viva*" of the mass, why does it waste and destroy it? and why in the same substance is it unequal in action? We know and judge only by effects. Whatever our assumptions, infinitesimals, the working units of nature alone are disclosed; with them science is familiar and great its insight, a wondrous chain of effects is disclosed resulting and interdependent. By *minimums* we judge. We talk learnedly of germs, particles, atoms, and molecules, but when a complex phenomenon arises, in the *maximum* result we confuse our *minimums*, the initiation and its accompanying stages are lost sight of.

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[1] "The heat and light of the sun (according to astronomers) do not reside in its mass but in the coating which lies on its surface. If such a coating were fixed there by the force of universal gravitation, how could we avoid having a similar coating on the surface of the earth and all the other globes of the system? If light consists in the vibrations of an ether, why has the sun alone the power of exciting such vibrations? If the light be the emission of material particles why does the sun alone emit such particles? Similar questions may be asked in regard to heat whatever the theory we adopt on the subject." (Whewell, B. T., 171.) He commences by saying, "No one probably will contend that the materials of our system are necessarily luminous or hot." Science points to the fact that all the orbs are self-luminous, and that all astral and planetary bodies are magnets. This established, the theory of the direct transmission of heat *as heat* from the sun to the other orbs composing his system is untenable, the rule of the inverse square interposes. The action induced is that of a force, magnetic for instance, which by its correlation becomes heat. We can then understand the bond of unity which connects orb with orb, not merely those of the planetary system, but all the orbs which throng in space. No heat hypothesis *as heat* would afford the universality of action; by the correlation of forces *alone* can any reasonable theory be suggested. We then have heat as a principle, conditioned as to facts, transfusing and transforming. Now, one condition representing the principle, now another. Heat as a vibration accounts for but little, heat as a principle accounts for all the forces. If heat (the principle being denied) be adduced as the solar fact, why when on the top of a mountain, nearer the sun, is the temperature reduced? Newton's first letter to Bentley was induced by the vagueness of the heat hypothesis. Had the bearings of magnetic action in his time been understood, we should probably have had a different hypothesis to that which is now assumed as the basis of astral and planetary motions.

When by a possibility the initiatory fact is discerned, we find the perfect adaptation of a means to an end. When the perfected organism, Man, is in discussion, motion, a casual and subsidiary fact, is substituted for life and intellect. We can have no motion without heat; on the other hand it can be said, we have no heat without motion. Which is the antecedent? The white light is split by the prism into coloured spectra—that is, the colours comprised in the white light are disentangled by the refractive powers of the prism. Yet it could be as consistently said that the constituent colours of the white light are the creations of the prism, as that heat (as a principle) is the effect of motion. If by a possibility heat could be removed from the universe all things would collapse; with life and consciousness perception would be annihilated, there would be a resolution into the primordial cause; dissipated it could not be, because as was its commencement so is its continuance.

In every fact we find intelligent arrangement; that which arranges cannot be the condition, or the mode of the thing arranged, —hence intelligence cannot have arisen from that which it formed and moulded. Finite intelligence and infinite intelligence have the same fundamental root, the difference being degree and quality. The first, the relative fact; the latter, the agglomerated whole, comprising in itself both quantity and quality, in it there can be no parts; each part is the whole and the whole is present in every part, thus we can say intelligence is eternal, the beginning and the end (the for ever present) its unity. The beginning is always beginning, at least such must be the reasoning of a finite intelligence which can only comprehend *that* it can perceive or conceive. No conception can present a beginning which is always existing, and continuing, as a tangible fact, and no individualization of thought can present an end as a demonstrable fact. We see change and only change, an eternal circle of things beginning in its end and ending in its beginning. The condensation of evaporations collected in the atmosphere falls to the earth as rain, this forms springs and brooks, springs and brooks rivers, rivers seas; the evaporation of the seas again possesses the atmosphere, and we have the same round of effects; this is the law of all phenomena, we have the gas, the liquid, the solid: reversed, the solid, the liquid, the gas, conditioned as facts, the mechanics, chemistry, and physics of intelligence. A thousand years ago, John of Erigena said, and thousands of years before him the Druids had said, in their synopsis of the old world science, "*In intelligence all Being commenced and into intelligence all Being will return.*" Thus eternity is Intelligence and Intelligence Eternity. If then Intelligence be the eternal fact of all things, Intelligence, whatever may be its particled presentment, is individualized in man; being eternal, it must be immortal, because in itself it has all quality and quantity and is not subjected to change. Thus we go the round of the mill horse, we argue in a circle. A vicious circle logicians call it, but any way it is the fact of nature.

All ideas of beginnings and endings are finite ideas, and in the Infinite alone can find their solution. We conceive of the unseen world as a possible or a probable, and so it remains the unknown, an "open secret." If the significance of spiritual facts are ignored in this life there can be no explanation.[1] The eternal fact of phenomena is intelligence, all springing from it must inherit its qualities or be in unison with it: hence we are surrounded by Eternity, Immensity, Continuity; that which we perceive being but effects resulting from changes. If in the unknown there be existence, it is an existence in intelligence; Synthesis will there take the place of analysis, and in the principle will be discovered *all it comprehends.*

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[1] As well a symmetrical figure might be sought for in a lens of an unequal surface as to expect from science a solution of the principles of the inner nature of man. "The wise man accepts details, investigates, balances evidences, and then decides. The fool decides."

All parts of an organism are relative to the whole, and by evolution are developed from pre-existing parts.[1] Here we meet the recuperative energy which repairs its waste. A machine is composed of unrelated parts, not one part proceeding from the other; when specially adapted they become related units, having no recuperating energy; *waste implies their destruction.* The action of the machine is subordinated to the moving power. Organisms are sympathetically co-ordinated. Thus, undue action in one part produces its effect on different organs, as the action of a secreting cell in the liver re-acts on the brain. An undue action of the brain will check the secretion of a gland, or relax the sphincters of the bladder. A variation, however slight, in the composition or structure of the parts, will frustrate the organic activity, or spend its energies in a new direction.

To state the problem of the evolution of life truly, we go back to the monad or protamœba, the living jelly speck, nourished by absorption and multiplied by fission, germination, or spores exhibiting the merest faculties of vitality, nutrition and multiplication; life could not be the outcome of these faculties, because before they could act the life must have been instituted,[2] and this rule must hold in all animate forms. The initiating fact must be the preceding fact; hence it follows that the functions in their endless display, consciously or unconsciously performed, are the facts of the motor-vitality. If the life ceases the function ceases, but if a function ceases the life may exist, as in the severance of a nerve. When the life-energy increases muscular action, there is no alteration in principle; the vehicles of conduction work with increased effect, but there is no *creation* of the moving principles. Give to the water channel a greater capacity and we have a broader sheet and an increased power, but no logic can prove the channel created the function of the water. Organ can only mean the vehicle by which a function is displayed; the lowest rhizopods are said to exhibit the life without organization, yet they display function, and function implies organization. It is to subtleties we owe the assumptions of automatic action for animals and man.[1]

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[1] "The system of animal bodies is simple and universal, notwithstanding the amazing diversity of forms, (it) not only embraces all living creatures" and "has been continued from periods . . . . before the last revolution of the earth's surface had been accomplished." (Bell, *Bridg. Treat.*, p. 222.)

[2] "Nerves can perform no functions unless supplied with blood, all qualities of life being supported through the circulating blood." (Bell, *Bridg. Treat.*, p. 185.)

The *whole stress of the argument is present or absent consciousness.* The argument *pro* makes the normal the abnormal fact of life. Any derangement of a function excites consciousness. Carpenter saying "the ego determines to do a certain action, and commands the automaton to do it" (*vide* note 2, p. 5), is exactly what Amberley suggests—that the soul is without the machine (body), and instructs the machine what to do. Huxley's *sensible automaton*, which excited so many remarks, is absolute wisdom compared with such deductions. It is possible to know the method of a natural fact without knowing the true or primordial initiation of the motive power. We know life and mind exist, but we do not know *the how* of their existence! and therefore it seems rash to insist upon a definite formula in respect of them.

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[1] All internal motions of animal bodies, as digestion, production of secretions, repair of injuries, or increase of growth, occur without consciousness, in sleep, in waking hours, and in the fœtus, as in the infant after nativity, and depend upon irritative fluids. So actions of men and animals, which seem neither to be directed by appetite, nor taught by experience, nor deducted from observation, have been referred to instinct, and have been explained to be a *divine something*, and the animal has been thought little better than a *machine*. The *irksomeness* attending a continued attitude of the body, changes from heat, cold or hunger, &c., excite to *general locomotion*. *Sensations* and *desires* are as much a part of the system as *bones* and *muscles* are another part, hence are *natural* or *connate*; but neither can be termed *instinctive*, as that refers only to the *actions* of animals.

Sensations and actions are experienced before nativity, as cold, warmth, agitation, rest, the struggles of the limbs, &c. The actions of young animals have been acquired like those attended with consciousness, *by the repeated efforts of our muscles under the conduct of our sensations and desires*. The chick in the egg moves its feet and legs, moving in the liquid surrounding it, shuts and opens its mouth; puppies before the membrane surrounding them is broken move, put out their tongues and open their mouths; calves lick themselves and swallow their hairs; towards the end of gestation the fœtuses of all animals drink part of the liquid in which they swim. The white of the egg is found in the mouth and gizzard of the chick, and the *liquor amnii* in the mouth and stomach of the human fœtus. The motions in the fœtus are such as by which they can best change their attitude. The growth of parts first wanted to procure subsistence are farthest advanced before nativity. The colt and lamb are more perfect than the puppy or rabbit. The chick of the pheasant and partridge have more perfect plumage, more perfect eyes, and greater aptitudes for walking than the callow nestlings of the dove or wren. It is only necessary to show the first their food and teach them to pick whilst the latter for days obtrude a gaping mouth. The fœtus learns to swallow before nativity. The inspiration of air is different from swallowing and arises from a suffocating sensation, which sets in motion the breast, ribs and diaphragm, and thus respiration is discovered and continued. So creatures suck from the teaching in the fœtus. Galen took a brisk embryon from a goat without its being able to see its dam, and put it in a room, where were vessels filled with wine, honey, oil, milk, &c., fruit and grain. It got on its feet and walked, shook itself, scratched its side with one of its feet, smelt all the things in the room, and then drank the milk (*Zoonomia*, vol. 1, p. 187-194.)

If organism be the multiplication of a particular germ from which all forms of life by successive gradations have arisen, it is probable this germ was not localised, but that in all portions of the earth it existed in its inherent principle and became clothed with life as conditions were assimilated to its uses. It is idle to talk of one germ or of a number—the first presentment of the phenomenon of life was that of a continuing principle: in earth, in air, throughout our world, the materials of the protoplasm are present, and wherever they are presented as an albuminous compound, the vital energy, all conditions being satisfied, is present. Nature makes no leaps.[1] All the conditions of the law being in active relation these relations may continue through long lapses of time; but the law *may*, in its particular action, have exhausted its energy, or new conditions *may* have arisen enforcing modifications, or it *may* be the energy was accumulative and the time came when new developments arose, having application not only to a change of external form but to internal conditions. When the internal condition is modified a change in form becomes imperative. The undue development of or the suppression of an organ would modify the whole structure. Huxley has most ably traced the modification of the lizard form until it becomes the bird, and with the aid of Marsh's discoveries in America the genealogy of the horse from its five-toed ancestors.[2] The theory of evolution appears to present this law. If the modifications are self-supporting they are perpetuated, otherwise they die out. Nature selects with greater emphasis than all modes of art. In the vast periods of geological time there is room for all the variations we find, development being the fittingness of the fact to the environments.[3]

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[1] What I contend for is "the necessity of certain relations being established between the planet and the frames of all which inhabit it; between the great mass and the physical properties of every part; that in the mechanical construction of animals, as in their endowments of life, they are created in relation to the whole planned together and fashioned by one mind." (Bell, *Bridg. Treat.*, p. 8.)

[2] There are rare instances of a horse having digital extremities. Suetonius says there was such a horse in Cæsar's stables, another was in possession of Leo X. G. St. Hilaire says he had seen a horse with three toes on the fore-foot and four on hind foot. Such an animal was lately exhibited both in London and Newmarket. (Bell, *Bridg. Treat.*, p. 91.)

[3] "The magnitude of the earth determines the strength of our bones and the power of our muscles; so must the depth of the atmosphere determine the conditions of our fluids and the resistance of our blood vessels; the common act of breathing, transpiration from the surfaces, must bear relation to the weight, moisture, and temperature of the medium which surrounds us," "our body is formed with a just correspondence to these external influences." (Bell, *B. T.*, p. 7.)

When it is contended that function is not exhibited until the structure is formed it seems to be confounding cause and effect. Function (vitality) collects the products for the formation of the structure, and infusing into the product its own energy becomes thereby its function. If use enlarges a structure, the enlargement, *i.e.* the growth, is due to the interfused function, that underlying energy, which not only reforms, but occupies; thus muscular enlargement is due to function, and the power of function appears to be increased because there is more room for the display of its energy. H. Spencer says function preceded structure. Rhizopods exhibit life without organization (Huxley).[1] Lewes retorts, life cannot be presented without a living body, and every living body must have structure of some sort, some special configuration of the parts. This is all very true; but how came this "structure"—this "living body"—this "special configuration?" If we cannot say *the organizations were self-instituted, then the formative function must have preceded them.* It is the feeblest and, apparently, the most insignificant life organizations which are the true structural units; functionally formed organizations displaying functions, crowding in myriads of millions—wherever animation exists they are, (cells), and to go further, the objective inorganic is due to them (*supra*, p. 18); *thus they become the porteurs of the material—the masons of the earth.* Their organization is their life, or they could not have displayed their functions, which are assimilating and aggregating. It is possible to say that function and organization in objective phenomena are synchronous in action; but this can only be said where the precedent function was transfused into the motion of the organism.

The protoplasm is common to animals and plants.[2] So close is the resemblance in the diverging conditions, that diatoms were once regarded as animals;[1] the spores of some algæ are first free swimmers and appear to be creatures, but they collect in groups in the same way as inanimate substances. In infusorial life such instances occur and baffle the most accomplished microscopists. Hydrocarbons abound in plants, and are rarely found in animals. We have similarity in origin, but absolute diversity in development, yet the same law finds its repetition in animal and plant, as though the type and antitype were presented. It is probable particular environments determined the departures, and the divergences were perpetuated. Without phosphate of lime there were no bone, yet phosphates abound in plants; animals alone have bone, because

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[1] Bell called "the consciousness of muscular exertion the sixth sense." It was this idea which led him to the investigation of the nerves (*vide lectures*).

[2] [Vegetable, as well as animal fibres, are excited into a variety of motions by irritation. The sensitive plant and mimosa are examples. The *Dronæa muscipula*, its leaves are armed with spines at the outer edge and spread around the stem, on the contact of an insect the leaf shuts like a steel trap. The various secretions, gum, resins, &c., seem brought about in the same manner as in the animal glands. The moisture is converted into sap, whilst the power of absorption in the roots and barks of vegetables is excited into action by fluids applied to their mouths like the lacteals and lymphatics of animals. Plants may be considered as less perfect animals. The tree is a congeries of living buds resembling coralline, congeries of animals. Each bud has its leaves and petals for lungs, and produces its viviparous or oviparous offspring in buds or seeds; the bud roots, interwoven with the roots of its other buds, form the bark; the only living part of the stem annually renewed is superinduced on the former bark and forms concentric rings. A new tree is produced by a branch, whence it would appear that the buds of deciduous trees are so many annual plants, and the bark a contexture of the caudexes of each bud. The irri-

tability of plants like animals is liable to increase and decrease by habit. The stamens and pistils show marks of sensibility, approaching each other at the season of impregnation; many close their petals and calyxes during the cold part of the day, and in darkness. This cannot be ascribed to irritation. The approach of the anthers to the stigma must be ascribed to love, hence to sensation. They also possess some degree of voluntary power as in their sleep (a temporary abolition of voluntary power), and in the circular movements of the tendrils in the effort to turn the leaves or flowers to the light. The associations of fibrous motions are the same in plants as in animals. In the sensitive plant one division irritated into contraction, the neighbouring ones contract also. It is the same with the *syngenesia.* A sensitive plant leaf, slit by scissors, after a few seconds seemed sensible of the injury, the whole branch collapsed as far as the principal stem. The sap vessels in early spring, before the leaves expand, are analogous to the placental vessels of the fœtus; the leaves of land plants, to lungs, of water plants, to gills. Other systems of vessels resemble the *vena portarum*, or aorta of fish. Their digestive power is the same, converting fluids into sugar; their seeds resemble eggs, their buds and bulbs, viviparous offsprings. Their anthers and stigmas are real animals, attached indeed to the parent like *polypi*, but capable of spontaneous motion—affected by love and have powers of reproduction. The male flowers of the valisnaria approach nearer apparent animality, they detach themselves from the parent plant and float on the surface of the water to the female. Other plants discharge the fecundating farina, which the air carries to the stigma of the female flowers—"Can this be effected by any specific attraction?" E. Darwin asks; "have vegetables ideas of external things? do they possess organs of sense?" It is shown, some, as the mimosa, dronæa, the drosera, and the stamens of others, as the berberis and syngenesia, are sensible to mechanical contact, *i.e.* have a sense of touch, and a common sensorium, by means of which their muscles are excited into action. How do the anthers and stigmas know others exist in their vicinity? He asks, "Is this mechanical attraction or love?" The latter has the strongest analogy—for reproduction is the consequence. They have also sense of smell, and may possess a faculty of perceiving as well as producing odours and, a discriminatory power to distinguish the variations of temperature, of moisture, of light, and of touch. He finally concludes—"they possess ideas of many properties of the external world and of their own existence" (*Zoonomia*, vol. i, *Vide article*, "*Vegetable Animation*," p. 135).]

[1] From the age of Aristotle to that of Linnæus, it may be said no systematic classification of animals was attempted or at least adopted.

the absorbents are so constituted as to assimilate the substance. Say what we may, we must go behind the organism and deduce its constituents from the inorganic; we then have a filiation of affinities. This sounds like materialism. It is one thing to say that an elemental compound is "the physical basis of life," but quite another to say it forms the platform whereon life is exhibited. Life is the fact and not the incident, thus the organism is the casual.

Tyndall at Manchester said, "Everywhere throughout our planet we notice the tendency of *the ultimate particles* of matter to run *into symmetric forms*, 'and that the very molecules seem instinct with a desire for union and growth'—molecules being *imaginative symbols;* imagination may run into imagination and associate as an idea, but we do not get beyond 'scientific imagination.' 'Ultimate particles of matter,' as science knows them, are gaseous; do these gases run into 'symmetric forms' and become objects of perception? The *method* of nature is the inherent capacity to mould and unfold; the cause of the method, the antecedent principle which impulsed it. If there be the implication of a cause, however indefinite, we are not far from that idealization of the mind termed Deity. It is not because the cause is 'unfathomable' that, as Spencer says, it is 'unthinkable,' or that it "implies the establishment of a relation in thought between something and nothing'" (*Prin. Bio.*, vol. i., p. 336). In the material view this may imply a logical dilemma, but a logical dilemma does not make a truth an untruth, it merely displays a wanting power of exposition.[1] Where, in natural facts, are we not involved in this dilemma? The *coalition* of two gases in forming water is an unfathomable fact, by Spencer's logic, therefore, "unthinkable." We have the method of the fact, but of the cause of the coalition we know nothing. Spencer confidently asserts (*First Principles*), "Matter and motion, as we know them, are differently-conditioned manifestations of force," and yet this force "must for ever remain unknown," so, unthinkable. When he talks of "the ultimate of ultimates," what have we but the primal cause?[2]

There is no distinction between the organic and inorganic in constitution, and if the scientific idea is accepted, then nerve-[1] action is but an undulatory thrill from the centre to the surface. The same undulating fact we find in the inorganic, interlaced as it is with electrical conductors, every shock causing its energy to be felt as far as the conducting apparatus extends. If it be assumed the organic undulations are of the protoplasm, we fall back on the shaking jelly. The distinction, so far as we know, between nervous undulation and electrical vibration is, that the one occurs in a sensitive body and is inbred by itself, the other in lifeless forms, gathering their powers from the great outside reservoir of nature.

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[1] Huxley says, "Logical consequences are the scarecrows of fools and the beacons of wise men" (*Fort. Rev.*, Nov. 1874).

[2] In speaking of the development of a plant or animal from its embryo, Huxley says, "The plastic matter undergoes changes so rapid and yet so steady and *purposelike* in their succession, that one can only compare them to those operated upon by a skilled modeller upon a formless lump of clay" (*L. S.*, p. 260).

Lewes tells us "it is sufficiently acknowledged among scientific teachers that every problem of mind is necessarily a problem of life." "It is enough that mind is never manifested, except in living organisms, to make us seek in an analysis of organic phenomena for the material conditions of every mental fact." "Mental phenomena . . . . can only be the objective phenomena of vital organisms." "The protoplasm is an organism because it feeds and reproduces itself."

We are to seek mind in an analysis of organic compounds—what is to direct our search? even life escapes the vigilance of the searchers—may not the organism, the mind, and the life, be as distinct as alcohol and a vessel containing it. Throw forth the spirit, the vessel remains, and the spirit is a continuing quantity. When life and mind pass from the organism we have the analogous facts. Before "the material conditions of every mental fact" are found, it appears quite needful to prove that mind has its origin from matter, as it is quite possible for a thing to be in a thing, yet not of the thing, may act with it, and apparently form a part of it, yet be utterly and entirely distinct in composition, as colour in substance; as in the illustration, we might just as well seek in the vessel for the phenomenon of the alcohol. No knowledge of structure or function ever disclosed the principle, life, and no analysis of life ever disclosed the principle, mind. We know life and mind exist because we are conscious of them as effects occurring in organic forms. It seems an outrage on all reasoned analysis to say because the life is connected with the organism and mind with the life, that in the compounds composing the organism we are to seek their bases (roots). The life is that by which the organism exists, and the mind that by which its motions are directed.[2] There can be no questions of morphology or physiology here, for we have nothing to do with structure or the ramification of vessels, &c. Heat is denied to be a principle, and presented as a material vibration;[1] life and mind derived from matter and consciousness shivered into states! The only changeless phenomena we know and of which we can speak with absolute certainty are, Life and Heat, Consciousness and Intelligence. The two first are necessary for the existence of phenomena, the two latter as their interpreters.

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[1] The "perfection of the nervous system is that each nerve is made susceptible to its peculiar impressions only." "The nerve of vision is as insensible to touch as the nerve of touch is to light." (Bell, *Bridg. Treat.*, p. 153.)

[2] The hand supplements the intellect and presents the proof of that principle of

We may learnedly talk of germs and tissues and interlacing forces, but we are never rid of the fact that when the life flies the organism ceases to be. Whatever may be the assumptions of the vitalist, they are insignificant when compared with those of the materialist. It is patent that the vital fact survives in the germ, whilst the organism is dissolved into elemental gases, again to be rehabilitated, again to become vehicles for an ensuing life.

Because the organism is sustained by nutrition, does it follow that the nutriment creates the life? it repairs the waste when the assimilated parts worn and exhausted are exuded; waste to the particular organism, but not waste in the grand economy of nature. Organisms have affinities for soda, potash, lime, magnesia, &c.; in the serum of the blood is phosphate of soda, in the nerve, phosphate of potash, in the muscle, phosphate of magnesia, in the bone, phosphate of lime, &c. In the organic arrangement there is chemistry in a minute and effective form; it is all orderly arrangement; there are no "wrenchings;" the substances are assimilated, and through the absorbents the various parts of the structure are nourished; each adapts that fitted for its purposes. *The selective power is of vital action;* the chemistry and mechanics of nature may be imitated by art. Vaucanson's duck was said to digest its food.[2] Our greatest fact of simulation is Edison's

adaptation which so prominently presents the fittingness of purpose in animal economy (*vide* Bell, *Brid. Treat.*, c iii). The division of the fingers combines motion with sense of touch, and adapts (see p. 6) the hand to grasp, to feel, and compare (*ibid.*, 107). On the perfect mobility of the thumb depends the power of the human hand (the monkey has no *flexor longus* of the thumb.

The whole facts of the animal system are so perfectly connected that even the fragment of a bone, be it of the jaw or spine or an extremity, tells its tale (Cuvier).

[1] By the undulator theory many properties are explained; there may be other explanations when the subject is more intimately probed. The consequence of the theory is—the luminiferous ether has no local motion, and produces refraction and reflexion by the operation of its elasticity alone. Its tenuity must be extreme, whilst its tension must be very great. The vibrations will be transverse (like the pull of the muscles); from this transverse character the laws of polarization follow. Some of the appearances, such as the fringes of shadows, &c., would occur whether the vibrations were transverse or not (*vide B. T.*, Whewell, p. 134, *et seq*).

[2] Houdin says, "One of its wings being injured, it was sent to me to repair and 'the digestion' proved to be 'a real *canard*.' A vase containing seed steeped in water was placed before the bird. The motion of the bill in dabbling, crushed

phonograph, for there is voice and memory—a memory and an utterance which will endure as long as the tin foil on which the sounds are magnetically impressed. In the microphone we have a magnifier of sounds.[1]

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the food and facilitated its introduction into a pipe placed beneath the lower bill. The water and seed thus swallowed fell into a box under the bird's stomach." The digestion was managed thus, " bread crumbs coloured green were expelled by a forcing pump and carefully caught on a silver salver as the result of artificial digestion" (*Memoir Robert Houdin*, vol. i, p. 174).

[1] [The problem of the conduction of sound has for a long time engaged the attention of the scientific. Hooke (1667) conveyed, by the aid of an extended wire, sounds to a distance; and a whisper could be heard a furlong off, although the wire was bent in many angles. Wheatstone (fifty years ago) showed the sounds of a musical box, many feet away, could be repeated by means of a deal lath, one end resting on the box, the other end in the room of exhibition, having on its top a sounding box. The same experiment was repeated by Faraday at the Royal Institution. Henry and others, in America, improved Wheatstone's idea. In one experiment two pianos were placed in houses on the opposite sides of a wide street, and the sounds produced on one piano were reproduced on the sounding board of the other. Helmholtz was the first who produced by the aid of electro-magnetism telephone effects. He placed a tuning fork between the poles of an electro-magnet, and by means of a platinum wire, one end of which was dipped in a cup of mercury, and the other attached to one of the legs of the tuning fork, he was enabled to obtain an intermittent current of electricity. By connecting the first fork with another of the same pitch, the vibrations of the one were communicated to the other. The sounds were regulated by means of a resonator placed in the front of the second fork. Page, of Massachusetts, forty years prior to Helmholtz, made investigations as to the production of sounds by the aid of electricity, which he called "galvanic music." The results of his researches when published excited considerable attention. Reiss, in 1860, produced a rough telephone, employing a beer barrel, a membrane, and strip of platinum attached to the membrane by sealing wax. The platinum representing the hammer of the ear, and by which the electric circuit was broken. The receiving instrument, a knitting-needle surrounded by a coil of wire placed on a violin which served as a sounding board. His subsequent arrangements were of a more complete character. To him is due the credit of being the first to conceive and carry out the idea of causing the human voice to vibrate a membrane and through it to break an electric circuit. Faber made an ingenious machine, by means of an apparatus he simulated the mechanical causes by which the voice is produced. Edison, on the other hand, obtains the mechanical effects of the vibrations. About four years ago Barlow invented the Lolograph as a short hand writer. It is a membraneous implement, the vibrations of the voice are received on the membrane and recorded by a fine hair pencil kept moistened with ink. The marks are curves similar to those made by Thomson's siphon recorder, the paper being uniformly drawn along by a Morse's feeder.

Telephones are of two characters—the thread telephone, a couple of boxes covered with a membrane and connected by a thread, the sound is perpetuated by talking into one box, the thread carrying the vibrations to the other, and the electric telephone, which converts the sound into electricity and retransforms it into sound, where it existed in the current of electricity running through wire, produced, it may be said *de novo*, at the receiving end of the cir-

Man is a finity in an infinity, an intellectual particle connected with the great positive, universal Mind. By the conceptive relation with this infinitude he is enabled to construe intelligibly the infinitessimal facts whose sum is phenomena, and find the *art of*

cuit. In the thread telephone the range of sound is limited. In the electric telephone practically unlimited. The greatest distance over which the telephone has yet been used in connection with the submarine cable is from Holyhead to Dublin. Bell's telephone owes its characteristic to a permanent magnet surrounded by a coil of wire—and to a disc of thin metal. Gray, of Chicago, a few years ago produced a complex instrument by which musical sounds could be reproduced and transmitted. This is probably the first electric telephone. Its details are deposited in the American Patent Office. E. Dolbear (another American physicist), produced a telephone in which he uses electro-magnets, and with his apparatus it is stated that low talking can be heard more distinctly than when a great effort is made. Edison, the inventer of the phonograph, has devised a telephone by which the sounds are intensified. He has also constructed on the same principle the tasimeter, an instrument of extreme delicacy for making observations on the heat of distant objects. Bell was the first to enter the field in a practical form. For some years he had been engaged in researches on electric telephony, and to him the credit is due of having been the first to consummate the articulating telephone. One of the most ingenious purposes to which it has been put, is the detecting the efficiency or non-efficiency of torpedoes fired by electricity (McEnvoy is the adapter). The phonograph electrically records speech by indentations on tin foil, by means of a turning apparatus, which on reversal reproduces the sounds. There is a difficulty in transmitting the sounds over ordinary or special telegraph wires, which makes it at present but little more than a scientific toy. Hughes (the inventor of the telegraphic type printer) produced the microphone. It was invented in December, 1877, and made public May, 1878. Originally most primitive in character, a halfpenny wooden box for a resonator, on which with sealing wax was fixed a small glass tube filled with a mixture of tin and zinc, the ends being stopped by two pieces of charcoal, to which wires were attached to three Daniels' cells (three jam-pots in circuit), the wooden box with one end knocked out served as a mouth-piece. The great secret of these inventions is the obtaining a perfectly constant remittent electric current, to obtain which various means are employed. The great effects of the microphone were obtained by connecting it with the Bell telephone. Professor Hughes is now enabled to dispense with the telephone, having discovered a receiver peculiarly delicate in character, being, in fact, the membrane or receiver of the thread telephone. On this drum he mounts his carbon apparatus which is attached to the centre of the membrane.

Various tales are circulated as to the modes of discovery of the phonograph and the microphone. It is said Edison, when trifling with his telephone, with the little needle of the diaphragm pricked his finger; on drawing it away, it left an interrupted line of blood on its surface by the vibration of the point. He placed some Morse's paper, so the diaphragm could travel over it, and speaking through the tube found dots and dashes inscribed; reversing the process, a faint halloa was heard, which he had shouted at the machine. Upon this he went to work, and produced his first phonograph. So also it is said the discovery of the microphone was due to the accidental breaking of a wire when some acoustic experiments were being tested by means of the telephone.

nature expressed in her work. The bubble reared on sensory facts bursts; sensation being but functional, hence is merely a method, which consciousness passively receives and reflects. The interpretation belongs to another category—intelligence. Sense expressions are symbolical presentments, perceptions of form. Kuhne's interpretation of vision shows our perception of it is representative. If facts as we conceive them *can only be* interpreted by intelligence, it follows they are the results of intelligence; and physics, chemistry and mechanics the objective presentment of the thought in which they originated; in the same way as a cup is the objective presentment of the thought of the designer, through the mechanics of the potter, symbolising its fact in an objective form. To say "*brute matter*," which is modelled at will, is the factor of its own fact, is neither *science nor reason*. If mind originates in matter (the thinking brain)[1] it cannot soar beyond its origin; there could be no conception of the unseen as a formative consequence, no abstract conceptions which could pass from mind to mind. In nature there is a consonance throughout, all is relative; the material connected by material ties, the immaterial or mental, by intellectual ties. Thus we arrive at the moulder and the moulded. If phenomena exist through impulse, then in the world of phenomena there is something besides matter. The casual must be sought in the actual, the impulsive in the beyond of matter.

In the teachings of the lecture-room and scientific theories, if materialism be not avowed it is inferred in "the terminology." A subversion by phrases, an ultimate which reason would construe as the completion, or end, means a beginning; so probably materialism may mean orthodoxy.

If we think our facts we cannot but perceive that intelligence is the underlying principle of all natural phenomena, an intelligence so wide and vast in character that it spans every fact. As science has no explanation of the *what*, the *whence*, and the *why*

The stretched wire, although talked at and plucked at, produced no effect, it broke and the telephone uttered a sound. The broken ends of the wire were placed together, secured by a weight, again faint sounds were heard. This broken circuit was improved and the microphone resulted. This might be said to be "Science herself rewarding inventors" by revealing some of her most hidden secrets. Let the accident be, or not be—the discoveries were due to the true intellectual interpretation of Nature speaking. She revealed her method, man applied it.]

[1] "The brain through which every impression must be conveyed before it is perceived, is itself insensible" (Bell, *Bridg. Treat.*, p. 162). "The heart is also declared to be insensible" (*ib.* 166). "The sensibilities of the living frame are appropriate endowments; not qualities necessarily arising from life; still less the consequence of delicacy of texture" (*ib.*, 167).

of matter, it is an insipience *authoritatively* to pronounce on the greater mysteries of heat, life, intellect, and consciousness.[1]

A Theist believes in the rule of God, a Deist confounds all in God: both may be tolerated by the orthodox, for they found their ideas in the intelligence of the Cause; but the Materialist, who thinks only in the fact from whence he emanated, must for ever founder in the mire of his own creation.

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[1] Thomson (W.) and Clausius arrive at the conclusion that the world at some period will infallibly come to an end—1st. The universe will unite in an enormous ponderous mass. 2nd. All visible motion will have ceased and all forces be changed "to mere molecular motions" in the shape of heat, "universally uniform in temperature," and this "state of death or rest will last eternally." This view, Loschmidt controverts (*Treatise on the modern theory of heat*). For argument, adopting the view that the sun is a slowly cooling body, and that his surface will solidify long after the planets have fallen in on him, the period of rest and death will arrive, but cannot be of unlimited duration, because it cannot be a state of equilibrium. (Parenthetically, it may be said, the theory of Andrew Jackson Davis, the clairvoyant, seems more reasonable; viz. that the visible universe is a manufactory of spirit, and that eventually all matter will be resolved into spirit, and be absorbed in the "*great* positive mind," which appears to be his idea of an entity or God, repeating, in other words, the hypothesis of John Scotus (*Erigena*).

Accepting the nebular theory of Kant and La Place, Helmholtz says the heat of the solar mass in the condensation would be represented by a temperature of 28,611,000° C. if it had the capacity of water, but if of carbonate of lime or silicic acid it would be 140,000,000° C. Thus, the heat of the interior of the mass would be increased to more unimmaginable sums; an explosion would then ensue, and a greater part of the heat would be converted into gravitation and the force of rotation, and the process of consolidation would again occur. This appears to be Loschmidt's idea of a kosmical period.

If there were any such sums of heat as are imagined, there could be no possible explosion, because there would be no material substance to explode, for all universal space would be possessed by heat. In kosmical hypotheses the solar system is not to be considered alone but with it the whole of the suns and systems of the universe. All these kosmical theories are calculated on the arbitrary assumption that there is no renewing energy. Reciprocation is as much a positive fact of phenomena as any other scientific hypothesis. Heat in all these theories is conceived to be specific, but if it be a mere undulation in the particles of matter it can have no specific character, and if the specific heat assumes the proportions of the numbers designated—which by other hypotheses reach 250,000,000° C., there would be no matter from whence it could emanate, hence heat cannot be the casual it is assumed to be. The reversion of all things into heat by these kosmical theories, shows the resolution of all things into a primordial principle (materially considered) *heat*. Figures are important factors in scientific analysis, and in their extremes are a *reductio ad absurdum*. Two jelly specks adhering produce spores. Scientifically, there can be neither contact with nor exudation from other substances but heat is elicited; then each infusorial speck is a revealer of heat—it is a quantity, however unappreciable. Multiply the jelly specks into the bulk of the universe and with them the revealed heat, and we arrive at a range of figures no numeration could name. This is the fair outcome of the heat hypothesis of science. Where does it land us? Reason says nowhere! We have of course the continual theories of *dead worlds*, which the physical astronomer points out; as the dark companion of Sirius, and that of Procyon; also incandescent suns and other mysteries, some reducible to some show of reason, and others merely imaginative creations. Science rarely errs by a rejection of the incredible, if by a possibility it can be dressed in a scientific phraseology: the really possible and probable is frequently rejected because it cannot be included in some scientific hypothesis or formula. Matter in the science of the time is the only probable possible—hence all which has not a material basis as a factor is not the possible.

CHAPTER IV.

Dual Man—Perception and Conception.

Mind is defined to be but molecular changes in the substance of the brain: Life "the molecular union of proximate principles of three classes in reciprocal dissolution—"structure, aliment, and instrument," as "a peculiar force temporarily associated with matter;" "an undiscovered form of force having no connection with primary energy or motion;" "a power capable of controlling and directing both matter and force," but arising from mechanical agencies. The energy of the mechanism is but the method by which nature moulds her fact; vitality, the subsisting link which tends to reunion and order, as mind and will, direct and control. To a commonplace thinker mind and vitality comprise all that can be conceived of thought and sensation, vitality, as the energy of the mechanism, and mind, the energy of spirit expressed as intellect. Call them the inbred vibrations of matter, what is the gain? There is no riddance of their inherence. Such utterances are the very charlatanry of science. With Emerson we might say, "Surely no one would be a charlatan who could afford to be sincere."

Man in whatever aspect he is viewed is a mystery rendered more impenetrable by the attempts made to solve the problem by mechanical and chemical explanations. He is a compound of all phenomena; not the kosmos, but of the energy derived from it. By his senses or the perceptive faculty he is united with objective or external phenomena, and with the unseen or subjective by his conceptive powers. Perception and conception pourtray his dual nature. The consciousness is impressed by both these natures, and makes man, so long as they are intertwined, a unity, probably, a scientific molecule. The metaphysician lends his aid to deepen the mystery. There is the admission of an existing soul, but then it is demonstrated to be a point without extension. The very principle of the Kosmos is the extended point or unit, so it is impossible to admit there can be in the Kosmos a point incapable of extension.

If extension be accepted in the sense of diffusion, there is no point, physically or metaphysically, in the extended range of the kosmos which is without it. If by the soul[1] is meant man's individualism it is extended wherever his influence reaches. As an abstract conception it is intellectual identity, not as a something derived from matter, but in the sense of arresting and controlling. In the animal man, perception, or instinct is the guide; in the mental man, conception or intellect. In the animal man we have an intricate mechanism, nerves, muscles, valves, conduits and bones, responding to the impulses of will and sensation; hence the organism becomes only a vehicle for their display. Anatomy has probed every part of the organized structure, but nowhere does it find the soul, or the life. In dead matter there is irritability by excitation, the muscle contracts, the nerves twitch—motion induced through impulse. In the living organism every motion is the result of impulse. There is no evidence to show that either life or mind are functions of structure. Function exists with structure, but an initiatory fact precedes both. Intelligence as the formative faculty precedes vitality, vitality structure; in such a corollary it is impossible to say that intelligence or vitality, are functions of structure. We cannot say that structure is the identity of the creature, for it changes on each moment; continually dissipated as it is continually replaced. Perhaps no more cogent *a priori* reasoning could be adduced in proof of the dual fact of man, than the for ever changing body and the unchanging and augmenting mind. The phase of nature is the continuous unity of two kingdoms, the material and the immaterial, illustrated in physics as matter and force, the ponderable and imponderable. A passive or receptive world and a world of active principles, in, but not of matter. Thus the intangible becomes the real.[2]

The *Ego* and *non Ego* are the consciousness of one fact, for the Ego could never be conceived without the non Ego, or the something without the self. We talk learnedly but the mischief is we talk seriously of *Egos* and *non Egos*, as if the Ego in the abstraction of thought[3] was not the conscious fact of the individualism of our identity. Science recognised in perception presents the intelligence underlying the methods of nature, as facts of

[1] The amber and the magnet were supposed by Thales to have a soul; digestion and assimilation by Paracelsus to be effected by a spirit (Archæus). Air and gases were at first deemed spiritual, "but when invested by a more material character were deemed the ghost (as shown by the derivation from *geist*," (*Grove*).

[2] "I cannot see how scepticism should arise out of the contemplation of the structure of the human body" (Bell, *B. T.*, p. 2).

[3] Abstraction, *when used independently in this treatise, means—the concentration of reasoning, special occupation of the mind to elicit a given end.* Not as Sir William Hamilton has it, "*the negation of attention.*"

law, ruling alike the floating mote and the revolving star, the germ and the developed conception. When science leads to a conception of causation sense-symbols fade in the purview, and the effort is made to define *the what* and *the why*. The wrangle of the schools arises more from the intermingling of perceptive and conceptive ideas than from the contention as to the ideal and real. The material philosopher counts his atoms and decides the kosmos is composed of units of matter, in its eternity combining cause and effect. The ideal philosopher sees all things in the ideal, or spiritual, therefore to him the ideal is the real; and whilst admitting the units, insists they exist through intelligent contrivance, condenses in the cause all succeeding effects, and asserts that by the eternity of intelligence matter exists, but he admits *secondary causes* and thereby gives an undue prominence to effects. The natural philosopher, taking note of infinitessimal quantities, brushes them aside in the truer aim of disclosing the religion of nature, wherein he finds an intelligence which man alone, of all created things, shares. Nature, contemplated in her higher or lower phases has the same cadence, harmony, symmetry and sympathy, whether exemplified in a sand grain or a world, and in the beyond a Providence exemplified in the laws of being, not supernatural although supersensual.

In philosophy the perceptive and conceptive constitute unity. Science defines her atom as "definite masses of matter," which in conception are inconceivable, to perception impossible. If there be such existing quantities the same providence attends them as masses of worlds or systems of suns, for sun hangs to sun as particle hangs to particle. The physicist imagines his unit whilst a sun or a planet is that of an astronomer, but to the philosopher, who superadds all, it is the unit of life; indifferent to him whether called into being at a word or whether all we know and see are the accumulations of progressive impulses.[1] The *all* to him is but the reflex of the originating thought and the conclusion to be drawn is that the religion of man is the idealization of nature as it is also the confession of essence.

The divinity of the cause is an existing fact in the minds of most men,[2] but when they think outside the orthodox formula,[3]

[1] "The ancient mythologists seem throughout, rather to have embraced the idea of generation than that of creation or formation; and to have thence accounted for the origin of the universe" (Hume, *Nat. Hist. Rel.* 29). "Epicurus, on being told *chaos* first arose, answered his tutor, '*And chaos whence?*'"

[2] "The idea of God, as meaning an infinitely intelligent, wise, and good being, arises from reflecting upon the operations of our own mind, and augmenting those qualities of goodness and wisdom, without bound or limit" (*Hume*, vol. ii, p. 25).

[3] "The only point in theology in which we shall find a consent of mankind almost

and find in nature an exemplification of this divinity of the cause, they are accused of Pantheism. Pantheism when analysed is providence dressed in mythic elements, making the *thought* which called the universe into being objective[1]—an idealization of wisdom and power. This idealization, when expressed as a sentiment, is the basis of Religion. Spinoza, a Pantheist and an Atheist![2] Surely the terms are not synonymous. The Theism of Spinoza is the spiritual identification of God in all things, not His personal existence in them. Who, acknowledging a God, will deny that God, or the ideal essence representing God, is not present in all things by His law? All ideas of God are individual conceptions. Practically (if a cause be acknowledged) God is everywhere existing in His own essence, and by His law existing in all things, yet it does not follow that all things are identifications of God, only that they exist by His ordinance. Such I understand are the teachings of Spinoza.[3]

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universal, is, *that there is invisible intelligent power* in the world" (Hume, *Nat. Hist. Rel.*, p. 25).

[1] The Greeks were not content, when expressing the provident care of the gods, with investing each grove, stream, mountain, dale, river, fountain, &c., with its attendant demon; they also concluded that man was surrounded by an unseen world of supernatural beings. Not only the things of earth had their typical deities—Earth, Air, Fire, Winds, the Moon, the Sun, but the fruits of the earth, the flowers and the corn. One god folded the blade, ere the beard emerged, others tended the joints of the stalks, opened the ear, and conducted it to maturity; presided over the crop and the garnering. Even the organism was cared for, the fœtus and birth were attended by gods. The infant took no nutriment but a god was present; over each internal function a god presided. The bones were knit, to stand and walk, the careful god was by to prevent a fall; no incident in life but had its attending care-taker. The virtues were under supervision, and the manifestations of intelligence—Comedy, Tragedy, Song, music and dancing. The discipline of right and wrong; household and domestic affairs had their Penates and Lares. Each human being had his two attendants, gods or genii; the one exciting to good, the other to evil. Night, sleep, death, became gods. This mythic Pantheism contained 30,000 gods or presiding deities. The original idea in its intuition, however perverted or degenerated, was the expression of a sense of Providence, a peopling of the unseen and unknown, by care-taking spirits. Plato held that all this arose through the perversity of man, through which, the one God delegated to Jupiter and inferior deities the care of man. All old world myths and newer superstitions are the outbursts of the same mythic elements (*Vide* '*Fiends, Ghosts, Spirits,*' J. N. Radcliffe, pp. 12, 19).

[2] Dean Stanley, in his address to the students at Aberdeen (1877), said: "When we look over the annals of ecclesiastical history we shall often find it is not within the close ranks of the so-called orthodox but from the outlying camp of the so-called heretic or infidel that the champions of the true faith have come." "It is not by the light of the orthodox, but to the aspirations of the excommunicated Spinoza was vouchsafed the clearest glimpse into the nature of Deity."

[3] Victor Cousin, speaking of Spinoza, says: "For him, God the self-existent being, the Eternal, the Infinite, too much crushes the finite and relative humanity—in short, he is so filled with the sentiment of God, that he loses therein the sentiment of man." "The Ethica is a mystical hymn, an aspiration, a sigh of the soul raised to Him who alone can rightfully say, 'I am that I am' . . . . adoring the eternal for ever; face to face with the Infinite, he disdained this transitory world," and "knew neither pleasure, nor action, nor glory." "Spinoza is an Indian Moni, a Persian

The mind postulates God, and the proof adduced is the universally intense desire exhibited by man to ally himself to a something beyond the sphere of his own being. Probably there are professions of atheism, but was its fact ever *realized* in any mind? Creeds become harmful only when it is assumed their *particular formula is alone the truth*, as if truth were not universal. The idea of God cannot be limited to one or within a thousand conceptions, and it is a treason against the dearest privileges of humanity and an impiety to say that man shall not in his own conception of truth symbolize his own ideal; there never was a thought formed of Deity but contained its own good. There was more of religion in the rejection by Servetus of the dogma of the double procession, than in the gloomy Calvin who caused him to be burnt to death for his rejection of it.

The Stoics built their ideas of the reality of life on the moral sentiments, virtue, and wisdom, and esteemed all who were without the pale of their particular teachings to be fools. They painted the shortcomings and depravity of man as the orthodox do. They rejoiced in "the birthday of eternity" as a deliverance from the bondage of the flesh and as an entrance into "the great eternal peace." Is this often reiterated depravity of man *an inherent principle* of his nature? or does it exist through the social distinctions instituted by man?[1] It is a grave question, and before we deny God's higher creation, mind, as a spiritual truth, it were well *first* to reflect upon the true nature of an Infinite intelligence, and *secondly*, to inquire whether this Infinitude, which must in itself be perfected purity, as containing within itself every excellence, could be reflected in an innately depraved formation.[2] This dogma of the innate depravity of man, if

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Sufi, an enthusiastic monk. The author whom this so-called atheist most resembles is the unknown author of the 'Imitation of Jesus Christ.'"

[1] If Canon Farrar succeeds in banishing Hell from dogmatic theology, however opposed his idea may be to the tenets of the Anglican Church, he will do much to eradicate from the mind the element of fear, and lead the devotee to a higher appreciation of the divine wisdom

[2] If the hypothesis be true that man (as an organism) is descended from some vertebrated form (all biologists appear to be of this opinion) it becomes an absurdity to suppose that in his origination man was mentally perfect; the organism being of progressive development, it is probable the mind also was progressively developed. This at least we know, mind progresses through culture. Adam in Eden may be a type of *what man should be*. The animal antecedent of man disproves all ideas of intellectual perfection, and therefore of his fall from this high position. The hypothesis being accepted, it is a higher aspiration to suppose that man by culture must make his own future, than to assume he *was arbitrarily degraded* from an exalted position, and by a faith in postulates unproved, has to redeem his lost state. The former position presents God in a beneficent aspect; in the latter the position is reversed, and God would be a capricious divinity inflicting degradation and pain on man; creating and authorizing evils for no apparent end. God as the author of nature

answered affirmatively becomes the denial of the fact of God. We are told morality can only spring from Religion; in one sense this is true, for all moral philosophy springs from sentiment, as representing a mental condition.

If the history of theologies be true, theoretically, moral truth is the fact of all, practically of none. Apostates from established faiths in all ages of the world, however eminent for moral conduct, have been esteemed Atheists, and therefore criminals. The philosophical Socrates died because his thought was in advance of his age; he acknowledged the existence of a supreme Deity. Such is the peculiarity of human thought, that frequently first comes execration, and then adoption. In Christian ceremonials are found Pagan rites and in theological tenets Pagan philosophies. The sedition of the populace of Alexandria led to the worship of the "Mother of God." The superstitious people saw only the reinstitution of the worship of Isis, but slowly it became a supreme object in catholic thought. The reality of thought is framed in the mind. Turn the page of life wherever we may, in the kinship of humanity we find the self. Thought treats of homogeneous man, and, mindful of his dual nature, asserts the spiritual entity. He may be connoted with the clod, but not the less within is the ethereal mind. The inorganic and the organic had but one origin; there is but one ultimate. A thousand years ago John of Erigena and Avicenna,[1] and later

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sends neither pains nor degradations. The miseries of humanity arise from social distinctions and the neglect of nature's teachings, which, by hereditary transmission have grown into miseries and pains. In animal races creature preys on creature by nature's ordinances. This is adduced as proof by the opponents of the idea of a provident God, that there is no Providence, and if there be a God, he is merciless and cruel! Livingstone, when under the paws of the lion, as he supposed without possibility of rescue, says, "He caught me by the shoulder . . . . Growling horribly, he shook me as a terrier dog does a rat. The shock produced a stupor similar to that which seems to be felt by a mouse after the first gripe of the cat. *It caused a sort of dreaminess, in which there was no sense of pain nor feeling of terror*, though I was quite conscious of all that was happening. It was like what patients partially under the influence of chloroform describe; they see the operation *but do not feel the knife.*" (*South Africa, Livingstone*, 1875 ed., p. 11.)

[1] Uberweg says Averröes interpreted the doctrine of Aristotle, "respecting the active and passive intellect, in a sense which is nearly pantheistic and excludes the idea of individual immortality. He admits the existence of only one active intellect and affirms it belongs in common to the whole human race; that it becomes temporarily particularised in individuals, but that each of its emanations becomes finally absorbed in the original whole, in which alone, therefore, they possess immortality. Averröes did not himself identify the universal mind with the Deity himself, but conceived it as an emanation from Deity and a movement of the lowest of the celestial circles."

Al Gazzâli (1010) the Mahommedan has a more beautiful theory. "God created the spirit of man from a drop of His own light, its destiny is to return to Him. Do not deceive yourselves with a vain imagination that it will return to Him as it left Him. When the body dies, the form you had on your entrance into the world and

Giordano Bruno taught this truth, and they repeated the philosophy of an older time: in all eras the record was true in nature: Man, the central link in which phenomena and essence culminate; by his perceptions he is linked with the things of sense, in his conception of ideal truth he soars to his God.

The poet Spenser says:

"For of the soul, the body form doth take,
For soul is form and doth the body make."

All are threads in the loom of time. We live in our insights, but the world we mingle with is not the world we think. In solitude man has revelations which, in the ascension of being, he will carry with him. Character is a force by which others are guided—a moral order; thus men of character become the conscience of the society to which they belong. The unthinking, will have a principle personified. When the desire was to have gods, whole generations were heaped into one person, combining in one hero the conception of a Cycle, thus heroic idols were obtained, a Romulus or a Numa (vide *Michelet's Roman Repub*). In these historic fictions eventually were centred the faith of the people—the human merging in the divine.

We perceive through sensation, but when sensation is translated in consciousness symbols by collation become perceptions. We can know by collective evidences; we do not attempt to pass through a barrier which experience has shown to be impassable. If we passively accept the position, then we are acting through our perceptions. If we would know the reason of the obstruction we must define. In defining another principle is disclosed—Mind, and we arrive at an abstraction. There can be memory and comparison in perception, but these are its highest functions. Instinct in itself is sufficient for every purpose of life. It is objected that instinct has no choice. Were this true it applies equally to judgment, the guidance directing an impulse is always selective, arising from what and how it may. If intelligence be restricted to ideas and abstractions there are none in instinct. All the complicated variations of instinct may be resolved into sensation, experience, comparison, memory, and consequently will, and we have the range of animal possibilities. When we speak of mind, we speak of ideas. It is doubtful whether these

your present form are not the same, hence there is no necessity of your perishing on account of the perishing of your body. Your spirit came to this world as a stranger; it is only sojourning in a temporary home. From the trials and tempests of this troublesome life our refuge is in God. In reunion with Him we shall find eternal rest, a rest without sorrow, a joy without pain, a strength without infirmity, a knowledge without doubt, and light and glory the sources from which we came." (*Conflict of Religion and Science.*—Draper.)

ideas have relation to sensation as their primal condition. Ideas and memory of experiences in relation to instinct (leaving out at present all notions of "the heredity" of descent) have a different origin from mental ideas and spring from a different source. Ideas are thoughts, as contradistinguished from sensations. The faculties of instinct exist with the mind, but are never transposed, although doubtless there is a blending of perception with conception, as a fact of consciousness. Instinct is a property or principle of organic animal life; hence we have organic or instinctive man; we have also conceptive or mental man. Instinct never originates, mind does. As the subject has been treated in the books, these distinctive faculties have rarely been defined and separated. The hypothesis has been, that the instinctive faculty of the animal and the mental faculty by which man is distinguished are one, and thereby has arisen the confusion so generally met with.

If it were possible to form a mechanical theory of mind, it must be grounded on the distinctive faculties of the cerebrum and the cerebellum. Phrenology makes this distinction. The assumption on which *the Science* is founded presents the brain as an instrument of many keys, the pulpy matter of the brain acting as a tympanum, or rather as a mirror, in which all objects, sensations and thoughts are reflected, the players on the keys, phrenologists term organs. They place the organs of sensation in the lower brain (the cerebellum), those of mind in the other hemispheres (the cerebrum), the cineritious matter serving as the connecting link of organ with organ.

Tyndall, in the Belfast address (*Times report*), says: that "Bishop Butler was *forced* to admit the immortality of animals. I fail to find the proof in 'The Analogy,' the observations on the subject being wholly inferential.[1] In Ecclesiastes[2] there is some ground for such an assumption, yet if an immortality for the beast is inferred, it appears to be transfused into that of man, and only through the immortality of man is the beast immortal.

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[1] The Bishop was arguing that death did not involve the dissolution and destruction of the organs of perception and motion. He says the argument does not lead us to suppose "the dissolution or destruction of living agents," "but it is said these observations are equally applicable to brutes, and it is thought an insuperable difficulty that they should be immortal, and by consequence capable of everlasting happiness;" but "suppose the invidious thing designed in such a manner of expression, as it is not in the least, in the natural immortality of brutes; viz., that they must arrive at great attainments and become rational and moral agents; even this would be no difficulty, since we know not what latent powers and capacities they may be endued with. There was once, prior to experience, as great a presumption against human creatures, as there is against the brute creatures, arriving at that degre of understanding which we have in mature age." (*Analogy*, p. 25, Ox. Univ., pr. ed., 1859).

[2] "Yea they have all one breath, so that man hath no pre-eminence above a beast" (ch. iii. v. 19). "Who knoweth the spirit of man that goeth upwards, and the spirit of the beast that goeth downwards into the earth" (*ib.* v. 21). "Then shall the

Animals have a system of nerves or a conducting apparatus by which sensation, motion, and will are transmitted, having their impact in the axial cord, of which the cerebellum is one termination and the medulla spinalis the other—here the nerves ramify and by a minutely arranged network appear finally to be lost in the muscles and tissues.[1] The organ of touch is spread throughout the skin and consists of nerves to receive the impression of bodies capable of resistance.[2] The encephalon (the brain as a whole) is the great organ of nervous power, receiving sensation and transmitting the fiats of will, yet "not one nerve of the body has its centre of innervation in the cerebrum or cerebellum."[3] The cerebral hemispheres are credited with the properties of sensation, the cerebellum with the property of muscular co-ordination, the spinal cord with the property of reflexion" (Lewes, *Phy. Bas. of Mind*, p. 159). The cerebellum is connected with the cerebrum by the pons varolii, by the pyramids, and diverging radii.

Instances are on record of children being born without the

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dust return to the earth as it was, and the spirit shall return unto God who gave it" (*ib.* xii. v. 7).

[1] "By the various efforts of our sensations to acquire or avoid objects many muscles are brought into successive or synchronous action; these become associated by habit and are then excited together, and . . . , gain indissoluble connections." So the motions of the viscera become conjoined by habit, *i.e.* by sensitive association (*Zoonomia*, vol. i, p. 63).

[2] The nervous tissues assume three forms. 1st. The nerves are bundles of fibres and fibrils enclosed in a membraneous sheath. 2nd. Ganglia, bundles of fibrils and fibres, sometimes with and sometimes without a sheath. 3rd. Centres serving as points of union for different organs. In the *invertebrata* the neural axis is the chain of ganglionic masses running along the under side (ventral) giving off nerves to the organs of sense and muscles. In the *vertebrata* the axis runs aloug the back (dorsal), called the spinal axis. Some of the nerves run into it from surface or sense organs (afferent or sensory); others pass out of it to the glands and muscles (efferent or motory). There are also commissural fibres, and a chain of ganglia and nerves known as the sympathetic, held to be devoted to the viscera and blood-vessels (*vide* Lewes, *Phy. Bas. of Mind*).

[3] When the cerebral hemispheres are artistically removed from a reptile or bird (frog and pigeon) the vital functions continue; they eat, drink, sleep, move their limbs separately and in combination, and are sensible to light and touch. The bird will thrust its head under its wing, fly if thrown into the air, avoid obstacles, and alight on an object, eat and drink if food be administered, and when the food touches the back of the mouth, swallow. There is a loss of the power of combining present states and feelings formerly in conjunction, a loss of spontaneity and the conspicuous phenomena assigned to intelligence. The sexual feeling appears to be preserved but without the power of gratification. If the cerebellum be also removed combined movements cannot be effected. Flight is impossible and walking a stagger. If the cerebellum alone be removed, all the perceptions and almost all the emotions, all the spontaneity and vitality are retained but the sexual instinct is gone. (Lewes, *ib.*, p. 162).

cerebrum; they lived for days and weeks—there was no apparent consciousness, but sensation must have existed, for they sucked and performed other functional offices—(Lawrence). Bell thrust his finger into the pulpy mass of the cerebrum; the patient felt no pain, nor was there sensation, excepting at the edge of the outer integument, but consciousness existed. In the face of these facts it is idle to talk of mixed functions, will, memory, and comparison obliterated, *motion* alone exhibiting sensation and the functions of life. It follows that the two brains, and the medulla oblongata and the spinal cord, have separate offices, which co-ordinated make the organism what it is; the unity of action resulting from the harmonious relation of all its parts. The inherent principles and the progression of organic existences consist in variations from the ovum or plasma through a gradation of forms until thinking man is reached, each variation possessing those functions, whether organic, instinctive, or mental, exactly suited to its place in the Kosmos. The invariable sequence and the particular adaptations refute all ideas of accidental interposition and the hypothesis *that matter of its own motion* is sufficient for all creative purposes.

Brougham said (*Dialogues on Instinct*): "The sceptical or free-thinking philosophers always lowered human nature as much as possible. They regarded it as something gained to their arguments against religious belief, if they could show the difference to be slighter than is supposed between man and brutes;" they appear to aim at the constitution of the universe without the "hypothesis of Deity." And that "Active memory and conception is implied in comparison, and that the animal possesses abstraction," and concludes, "that the animal mind and that of man are only differences in degree."

Sensation acts on the efferent nerves. Ideas, which become abstractions, are excited independently of sensation; although they convey the fiats of will by the efferent nerves, they are impressed on the consciousness without the aid of external images, and of themselves symbolize themselves. There is paralysis, where consciousness, thought and life exist, but sensation has ceased. If consciousness were a fact of sensation, consciousness were not exhibited without it. The same remark is applicable to intelligence. An existing consciousness without sensation appears to subvert the automatic hypothesis, for if they be not resulting facts each may exist independently of the other. The facts of instinct are all resolvable into sense expressions and sense experiences, as creatures banding together for the purpose of hunting, appointing sentinels, &c., the power of construction, whether of the insect or the animal, even the remarkable fact of the seeming prevision of depositing food for a progeny it will never see, as with the ichneumon fly, carpenter bee, wasp, &c. There are a few instincts which may be difficult to explain, and do not find their explanation in the distinction between "simple and composite faculties." If experience, "heredity," memory, and tribal transmission do not explain them, they must result from an innate potence: they cannot be assumed to be reasoned conclusions. There may be also an error in the observer or reporter. The wasp (*cerceris cupresticida*), paralysing the beetle that there may be living food for its larva, is stated on the authority of Lubbock. The ant architect is reported by Huber, the ants rolling themselves into balls, and floating on the floods; those spoken of by Livingstone, who built their nests on reeds above the flood mark; the driver ant, forming ladders of their own bodies that the others might ascend; the ants in Ceylon passing from branch to branch over bridges of their bodies formed by a double section, some leaving the main body and ascending to the opposite point, and there forming the half-link of the bridge, over which the others pass. The ring-tailed monkeys of Texas are said to pass rivers in a similar manner; linking themselves together by forearm and tail, they hang in a string suspended from a tree carefully selected, by an oscillation imparted to the whole group, a swinging motion is produced, and eventually a tree on the opposite bank is reached, and a bridge formed, over which they pass, and, as with the ants, the first link leaves its hold of the tree and ascends the suspended string, followed by its fellows, until all have passed.

At Dublin (*British Association*, 1878), Lubbock made some interesting remarks on ants whose habits he had observed, having collected thirty species, which he had in captivity. In England there are thirty species out of seven hundred which comprise the family. The ants are hunters, pastorals, and agriculturists. The first lived chiefly by the chase, hunted alone, and their battles were single combats; the second domesticated certain species of aphides, which they kept and tended, acting in concert; of the third he could not speak. He confirmed the statements which had been made as to their architectural skill, and had observed their attention to their young and the institution of slavery, and that other insects lived with them (according to André, 583 species); in some cases the association was accidental. He had not observed that varieties lived together, except there were slaves. The *sanguinea* and *fusca* he mentioned; the latter did the domestic work and foraged, but appeared free to come and go. One species he noticed would starve had they not slaves to feed them. They were kind to their friends, and recognised them after long absence; strangers were enemies—them they killed. He found no traces of warm affection, although when one had fed it would fetch others to share the banquet. They were capable of distinguishing colours, violet they avoided. Their sense of touch was delicate, but he had not observed they distinguished sounds, and could not say whether there was any difference of character in the same species, but there was in the habits of the different species. He seems to be of opinion that workers as well as queens produced eggs, as he had found them in habitations where there were no queens. The Texan ant (*Atta malefaciens*) (communicated to Darwin by Dr. Lincecum, and by him to the Linnean Society, 1861). According to him they prepare the ground, sow, reap, store the grain and expose it to the air to dry. (*Homes without Hands*, p. 370.) These are difficult questions,[1] and yet may be brought within the purview of the perceptive faculties, joined with "heredity" of descent, which in fact is the transmission of ancestral experiences, culminating in an individual species. On the attributes of the various species of dogs the great argument of the hereditary transmission of instinct is founded. The attachment of a dog to his master is a sensory impulse.

Instinct has combinations and contrivances which approach abstraction, but never become it, the peculiarity being *that the particular instinct is not that of an individual but of the whole species.* In the animal world the dog, the elephant, the horse, and the monkey, make the nearest approach to what may be termed reason, as the setter bringing the wounded duck across the river, and returning for the dead one, the monkey that had sugar given it wrapped in paper: on an occasion a wasp was inserted, and the creature was stung; from thenceforth, when anything was given it wrapped in paper, after shaking the parcel and placing it near its ear, if no motions were observed it was opened, but if there was movement within, it was flung away. Elephants used as decoys, &c. The horse which had lost its shoe going to the farrier to have it replaced. The sparrows assembling when the school children were leaving, whose habit was to throw them crumbs, but which did not appear on Sundays when there was no school, is noticed by Carpenter. An analogous fact may be observed by any feeder of poultry; not a bird is to be seen, but no sooner does the distributor of the grain arrive than the adjoining fences and trees become lined with them. There are cases where instinct appears to approach abstraction, but in these cases, whatever the peculiarity, it is always tribal, therefore inherited, all approaches to reason being the collective experiences of the species. If one ant had formulated a thought which had been adopted by the others, it were purely a mental fact, as contradistinguished from instinct, but not so when generalised throughout the species wherever found and hereditarily transmitted. Each genus of ants appears to be invested with some peculiarity confined to the species. The facts of mind are individual conceptions, not the characteristics of particular races of men. The increase of the power of the mind by means of culture appears to be confined to man, and it is often found that some individuals possess greater natural powers than those with whom they are associated, but this is not hereditarily transmitted, nor does it become the peculiar characteristic of a family. In uncultured races the mental power is limited, because the ideas are limited. Instances are recorded of individual members of savage tribes attaining to high culture, (the singularity being that in most of the recorded instances the individual has forsaken civilization and resumed the tribal habits). This shows the mental capacity is common to the races of man, but when it appears in a higher ratio than usual it is an individual and not a class distinction. No animal has yet been discovered using fire for any purpose. Monkeys will surround a fire which has been left in the woods, but never place on the flame a stick. To connect the fuel with the warmth is an abstraction they have not reached, but if the animal instinct and the reason of man were the same, man would not be the only fire user.[1] Back in the boulder clay (*Palæolithic epoch*) charred bones and sticks were discovered by Skertchly and Geikie, near Brandon, in Suffolk.

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[1] H. S. McCook calls this ant Myrmica malefaciens. He presented to the Academy of Natural Sciences, Philadelphia, a memoir on their habits, in which he confirms the observations of Dr. Lincecum, except as to the planting; to that he says, "they seem most fond of the grass *Austida stricta*, and it even seems possible they sow this for themselves." Although he will not commit himself to this fact, he says "the ants proved true harvesters. The seeds were carried into granaries through central gates, they were shelled, and the husks carried out and deposited in refuse heaps." Prof. Leidy said he had studied an allied species (*M. occidentali,*) in the Rocky Mountains, whose habits were like those described by McCook, but in addition they fostered a fine large coccus for its saccharine production (*vide Nat.*, vol. xvii, p. 433).

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[1] Ingenious theories have been formed as to the discovery by man of the use of fire. The most probable appears the finding some edible root in the vicinity of a lava stream. Humboldt states twenty years after the eruption of Torullo, shavings could be ignited in the fissures (Hornitoes). Heated stones in holes covered with earth is the cooking apparatus of many primitive tribes, and none have been discovered who do not possess artificial means of procuring fire. Its production at will was of importance, and doubtless exercised the early intelligence. Their usual mode of producing it is by hand-friction; the drill and turning string was a far-on tellectual advance.

Huxley says: "No one can doubt that the rudiments and outlines of our mental phenomena are traceable among the lower animals" (*Uses of Biology*). Here we face the real question. If the human mind be merely perceptive energy, then it is instinct. If the only line of demarcation were the power to draw (*ib.*) there were no distinction between animal instincts and mental processes.[1] The spider makes a geometrical web, the stays shortened or lengthened in accordance with the coming weather. The spider's web and the bee's cell, &c., are merely illustrative of a constructive power to delineate figures—an animal instinct. The power of abstraction appears to be an innate mental characteristic. If we follow historical records there is no time known when man had not this power. If we take as an illustration astronomical data for thousands of years before the Christian era this power of abstraction was exercised; the discovery of the cycle of the equinoxes is a grand illustration. If it be traced for a period of 25,000 years where are we to assign a limit? The split flints fashioned as arrow and spear heads imply their hafting, the perforated bone needle shows an adaptation to a use; the shaping, the hafting, and perforation, arise from an abstraction—and beyond, as mental characteristics, we have the sentiments—these no animal possesses; they exhibit emotions—emotions are instinctive displays; sentiments, abstract facts of mind, and beyond there is conscience,[2] the guiding rule of man with man; it has neither *rudiment nor outline* in any instinctive propensity, and further, it may be said to be an abstraction, not traceable to any perceptive instinct, nor to any mental conception, an *inherited* characteristic belonging to the races of man, in principle the same, but varied by conditions. To instinctive perception the sun is but an increment of heat, the stars points of light, the moonlight a dimmer day, but in abstraction, the sun is the centre of the planetary system and the intercommunion of star with star is attained. The power of communicating by cries or touch is a sense expression. We do not think in words, yet the power of expressing ideas in words is another feature of mental man. But for the *grand* distinctions between intellect and instinct man would not have condensed his individual experiences and added to them those of others, and could never have advanced beyond the highest instinctive combinations.[1] If the records of the instinctive faculty be true the highest achievements are found with the *araneidæ*. The water and trap-door spiders have contrivances outreaching the structural capacity of any creature below man.

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[1] The activity of causation "produces the great difference between the human and the brute creation. The ideas and actions of brutes are perpetually employed about present pleasures or their present pains . . . . They seldom busy themselves about the means of procuring future bliss or of avoiding future misery." (*Zoonomia*, i, p. 75).

[2] Dugald Stewart says: "Conscience although beautifully described by many of the ancient moralists, was not sufficiently attended to by modern writers as a fundamental principle in the science of ethics till the time of Dr. Butler." He is spoken of as the first discoverer of the great principle, but no one can be said to discover that of which all are conscious; he was the first who made it the subject of a full comment. Butler says, it is the principle "by which we survey and either approve or disapprove our own conduct &c., . . from its very nature claiming superiority over all other modes; insomuch that you cannot form a notion of this faculty, conscience, without taking in judgment, direction and superintendency. . . . . Had it strength, as it has right, had it power, as it has manifest authority, it would absolutely govern the world." Chalmers says: "This theology of conscience has been greatly obscured but never in any country or at any period in the history of the world has it been wholly obliterated. We behold the vestiges of it in the simple theology of the desert; and perhaps more distinctly there than in the complex superstitions of an artificial and civilized heathenism" (*Brid. Treat.*, p. 78.)

In the distinction between instinct and intellect and its crowning conscience is found the dual nature of man. With the animal world he has organic utility and instinctive faculties; were this all there were no distinction between animal and man. In the beyond is the mind in its individualised potence, unmistakably drawing the distinction between individualised thought and tribal instinctives.[2] The immortality of animals is probably a perpetual metempsychosis of the tribal distinction, in man of a continuing unity.

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[1] Galen says: "To man is given, in lieu of every other natural weapon or organ of defence, that instrument, the hand, an instrument applicable to every art and every occasion . . . . man therefore wants not hoof or horn or any other natural weapon, inasmuch as he is able with the hand . . . . to grasp the sword or spear" (*lib.* i, c. 11).

Ray says: "Some animals have horns some have hoofs, some teeth, some talons, some claws, some spurs and beaks; man hath none of all these, but weak and feeble and unarmed came into the world—Why? a hand, with reason to use it, supplies the use of all these."

[2] Marshall Hall, on the hypothesis of Unzer and Prochaska, founded his idea of reflex nervous action which Carpenter extended to the phenomena of intelligence as well as to those of muscular contraction. The idea was first directed to the instincts, or it might be said to the seeming prevision of insects, which were held to be the automatic results of reflex impulses, or, as Unzer says, "laws written upon the nervous pulp;" in other words, the nervous system of the insect is so adjusted as to react on its accustomed surroundings. Does it follow that a manifest design in an action, of necessity implies design in the actor? To Carpenter is given the credit of recognising that by a fundamental principle nervous activity produces in response to nervous stimuli, sensations and ideas. This system was that held by Erasmus Darwin nearly one hundred years ago, and discussed in his work '*Zoonomia.*' He does not limit the hypothesis to animals only, but extends it to man; it is the very principle on which he bases his theories of disease. He attributes emotions and ideas to pleasure and pain as their roots. The distinction between instinct and mind is that in the latter there is a power to determine the succession of ideas and detain any of them before the consciousness; to make them the guides of conduct and to combat opposing ideas. Instincts appear to have no such power of control. This great difference consists in the power of volition in the mind which is wanting in instinct, unless directed to a natural want. Cuvier said that the lower animals were experiments prepared for the elucidation of psychological roblems; in so far as mind, like the organism, is an initiative development, er's saying has force. There is nothing tentative, but throughout a purpose- rsued through uses to a given end.

In the actions of animals there sometimes appears to be a balancing of probabilities.[1] A careful examination shows the animal does or abstains from doing only by sense experiences and mechanical adaptations.[2] Animals and birds have the brain substance, insects and fishes something tantamount to it, which to them, as to man, is the mirror of impressions or organ of consciousness.[3] It could not be otherwise if the doctrine of progression be true. The illustrations of Darwin and others afford no room to doubt the principles upon which the theory is based.[4]

[1] Erasmus Darwin says he saw a wasp catch a fly nearly as large as itself, and separate the head and tail from the body to which the wings were attached; seizing the body it rose. A breeze blowing caught the fly's wings and turned the wasp round; it settled on the ground. "I then distinctly observed him cut off with his mouth first one of the wings and then the other," and with the trunk flew away. (*Zoonomia*, i, p. 263.)

[2] It is suggested, evidently by a careful observer, that the bee makes its cell a cylinder, as the silkworm does its cocoon and the burrower its hole, as shown by the outer cells, which are always semi-cylindrical where there has been no pressure from the inside. If a bee worked alone its cell would be cylindrical. Another instinct of bees, is to swarm and crowd together. They work at their cells side by side, and every bee working at its cylinder is surrounded by six others. Place a coin on a table, and put around it as many similar coins as will exactly touch each other and the central one; thereby is shown the geometrical law which produces the hexagonal form of the cell. Each bee is pressed upon by six others, thus the interstitial curves of the cylinders get squeezed out as they are made; through the mutual pressure every cylnder becomes a hexagon. The same cause produces the peculiar prismatic form at the bottom of each cell. The work is thus mechanical, in the same way as a horse pegged to a centre on being driven describes a circle.—*Rev. C. Lacy.* Grave objections have been advanced against this explanation.

In the same way the polypi work in concert to produce Neptune's cup. A particular form is produced by the tribal instinct. The bees it is said solve the most intricate of mathematical problems, viz. the figure which affords the greatest space with the greatest economy of material. There have been many ingenious explanations to account for the symmetry of the bee's cell (vide *Homes without Hands*). The idea of the cylinder becoming a hexagon by pressure has been before suggested, but the result, so far as I know, has never been so simply explained, as above. There are many cases of seeming prevision which defy so simple an analysis.

[3] "It is affirmed, and not without the support of a most curious series of observations, that the human brain in its earlier stage resembles that of a fish; as it is developed it resembles more the cerebral mass of the reptile; in its increase it is that of a bird; and slowly and only after birth does it assume the proper form and consistence of the human encephalon . . . . in these changes . . . . we nowhere see the influence of the elements or other cause than that predestined . . . . If . . . . we take the lowest link and look to the metamorphoses of insects the conclusion will be the same." (Bell, *Brid. Treat.*, p. 147).

[4] Canon Kingsley said: "To denounce Mr. Darwin's theory of evolution as an atheistic theory (whatever uses may be made of it by some of its advocates) is at once a crime and a mistake," "I agree with Dr. Asa Grey, in his admirable pamphlet on Darwin, that the tendency of physical science is not towards the omnipotence of matter, but the omnipotence of spirit; and I am inclined to regard the development of an ovum according to kind as the result of a strictly immaterial and spiritual agency" (Kingsley's *Life and Letters*). The continual assault from the pulpit

Tyndall says: "When we ponder it is the brain that thinks." The brain is the organ of consciousness, by which impressions of sensation and thought are transmitted; did the brain think, thought were merely a material presentment. That the brain is a mere vehicle for the exhibition of effects is shown in that its action accords with the respiratory and pulsatory movements, or as Giacomini and Masso call them, "Pulsations, occultations, and undulations." (*vide* note 1, p. 44).

Tyndall continues:—

> "It is by a kind of inspiration we rise from the wise and sedulous contemplation of facts to the principles on which they depend." "Newton pondered on all things." "He could look into the darkest object until it became entirely luminous; how light arises we cannot explain, but as a matter of fact it does arise." "Newton marshalled his thoughts, *or rather they came to him*, whilst he intended, his mind *rising like a series of intellectual births out of chaos* (*Mirac. and Spec. Prov. Frag. Science*, 5th edition).

With such contradiction we cannot wonder at his exclamation, "*Let us lower our heads and acknowledge our ignorance, priest and philosopher one and all!*" (*Frag. Science*, 5th edition, p. 421).

In "the new school of philosophy" we do not find that a sentiment[1] is an expression of mind, but that mind itself is non-existent, except as it exists as a physical consequent (see Bain, *Mind and Body*), thus sentiment becomes emotion.

The modulations of tone (music) may be an instinctive power. We find it with birds, but the existing thing (sound) has no part in instinct. The power to perceive differs from the thing perceived. Instinct uses that it finds, but does not define or create. Intellect defines, and may be said to create, for it constructs implements by which sounds are divided or condensed. The bird sings by an innate volition. The instincts feel a noise, the intellect seizes the noise, or rather so marshals the wave-impulses as to create a harmonious cadence from that which otherwise might be an undistinguishing clamouring.

"Pythagoras is said to have devised his theory of numbers by

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on the Darwinian theory is emphatically denounced by Canon Farrar, who advises unscientific preachers should at the least inform themselves of the facts of science before they assume to assail its premisses.

[1] "All the moral feelings, Argyll says, are founded on sentiment and nothing but sentiment;" we may "despise sentimentality" and forget "that sentiment rules the world." (*House of Lords*, Feb. 8th, 1877).

Dugald Stewart, in this connection, said: "The word sentiment agreeable to the use made of the word by our best English writers, expresses, in my own opinion, very happily those complex determinations of the mind which result from the co-operation of our entire rational powers and of our moral feelings, and Mr. Hume sometimes employs (after the manner of the French metaphysicians) *sentiment* as synonymous with feeling, a use of the word quite unprecedented in our tongue."

accidentally remarking that the hammers at a forge gave out musical cadences. On investigating the facts he found the sound was regulated by the weights of the hammers. His tests were the tension of strings by a weight, whereby he obtained the same accord; first a tone, then an octave,'and so on. On his experiments he founded his theory, which still holds its place in physics."

Sounds arise from substances in a state of agitation, or vibration. The rapid changes striking on the interior apparatus of the ear render them audible. In a second of time it is computed they range from twenty to thirty-two thousand; when they occur in regular succession they are the cadences we term music. An irregular agitation generates noise. Distinctions arise when the vibrations, or wave motions, occur in regular rotation, and the variations of these distinct sounds in a given time are notes in music; *e.g.* if twice as many variations in the particular period occur it is said to be an octave above a tone, and has twice as many vibrations as the tone itself; the second octave has four times as many vibrations, the next eight, each octave doubling itself. Thus an instrument having seven octaves the highest tone it accomplishes is one hundred and twenty-eight vibrations in the same time the lowest takes to make one vibration. A tone of the same number of vibrations has always the same pitch, however produced. The waves of sound are like the undulations on the surface of a liquid when its equilibrium is disturbed, occurring as a succession of circles. Two waves of sound which are similar will destroy each other, scientifically called "the interference of sound." Thus two tones will perpetually reinforce or perpetually destroy each other (*Helmholtz*).

"For attaining to the higher beauty which appeals to the intellect . . both harmony and disharmony alternately urge and moderate the flow of tones, while the mind sees in their immaterial motion an image of its own perpetually streaming thoughts and moods, just as in the rolling ocean this movement, rythmically repeated and yet ever varying, rivets our attention and hurries us along." "The streams of sound, in primitive vivacity, bear over into the hearer's soul unimagined moods which the artist has overheard from his own, and finally raises him up to that repose of everlasting beauty, of which God has allowed but few of his elect favourites to be heralds" (Helmholtz, *Harmony in Music*).

According to Timæus, Plato said the soul of the universe was composed of an admixture of divisible and indivisible essences, so that two together might be united into one, reuniting two forces, the principles of two kinds of motions, one, that which is always the same, the other, that which is always changing. The proportions of the mixtures were according to harmonising numbers, so that it is possible to know of what and by what rule the soul of the universe was compounded. Since the ancients conceived of the soul by means of motion, the quantity of motion developed in anything was the measure of the quantity of the soul; the principle was applied to the motion of the heavenly bodies.

In the school of Pythagoras twenty-seven had a mystical significance, and was considered as the perfect number. One represents the point; then two and three the first lineal numbers, even and uneven; then four and nine the first square and surface numbers, even and uneven; last eight and twenty-seven, the first solid and cubic numbers, twenty-seven being the sum of the whole.

The planetary velocities were reckoned in relation to tones; one tone from the Earth to the Moon; half a tone from the Moon to Mercury; another half-tone to Venus; a tone and a half from Venus to the Sun; one from the Sun to Mars; a semitone from Mars to Jupiter; half a tone from Jupiter to Saturn, and a tone and a half from Saturn to the fixed stars. Cicero said, "Such great

> motions cannot take place in silence, and it is natural the two extremes should have related sounds, as in the octave." Kepler improved on this; he says, "Jupiter and Saturn sing base, Mars takes the tenor, Earth and Venus the contralto, and Mercury is the Soprano." Pythagoras says, "We are alway s surrounded by this melody, and our ears are accustomed to it from our birth; so that, having nothing different to compare it with, we cannot perceive it.

When we look for these celestial harmonies in the relative distances of the planets we do not find the rhythm. Stated roundly, they are as 100, 67, 55, 44, 24, 16, 12, 10. Observation has shattered the harmony of the divine relation of numbers and tones; yet it was a pleasing idealization. Gravitation is a grand disturber, and resolves all into true mechanics. The planets with the sun and moon formerly made the mystic seven. We have the seven superior angels, the seven gates of Mithra, the seven worlds of purification of the Hindus, the seven hells of the Mahomedan, the Judaic seven angels, and the seven stars of the Pleiades (one now wanting).

General opinion points to Huxley as being a materialist. Is he one? He says:

> "I take it all will admit there is a definite government of this universe, and that its pleasures and pains are not scattered at random, but are distributed in accordance with orderly and fixed laws, and it is in accordance with all we know of the rest of the world, that there should be an agreement between one portion of sensitive creation and the other" (*Lay Sermons*), "harmonious order governing eternally continuous progress, the web and the woof of matter and force interweaving by slow degrees, without a broken thread, that veil which lies between us and the Infinite, that universe which we alone know and can know. Such is the picture which Science draws of the world, and in proportion as any part of that picture is in unison with the rest, so may we feel it is rightly painted" (*ib.*). Helmholtz appears to hold the same opinion. Elsewhere in the *Lay Sermons* we read: "The phenomena of life are dependent on neither physical nor chemical causes, but on vital powers; yet they result in all sorts of physical and chemical changes which can only be judged by their own laws." "Thought is existence, and certainly is to be found in consciousness; this may be conceived to be an idealism, which declares the fact of all knowledge to be consciousness, in other words, a mental phenomenon, and therefore affirms the highest of all certainties, and indeed the only absolute certainty, to be the existence of mind."
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> Novalis (Frederic von Hardenberg), as interpreted by Carlyle, comes before us as the most ideal of idealists. "For him the material creation is but an appearance, a typical shadow in which the Deity manifests Himself to man. Not only has the unseen world a reality, but it is the only reality, the rest not being metaphorically but literally and in scientific strictness a show." "Sound and smoke overclouding the splendour of heaven." "The invisible world is near us, or rather is here, in us and above us. Were the fleshy coil removed from our soul, the glory of the unseen were even now around us, as the ancients fabled of the spheral music."

The contention of the day is Matter or Intelligence. The first is continually passing from perception, the latter always existing.

Viewing the question as one merely of phenomenal effects on which side is the doctrine of probabilities? That there is "a definite government of the Universe" shows an antecedent to objective effects.

> Bain says that "thought is at times so quiet . . that we might suppose it conducted in a region of pure spirit, merely imparting its conclusions through a material intervention. Unfortunately for this supposition, the fact is now generally admitted that thought exhausts the nervous substance as surely as walking exhausts the muscles" (*Mind and Body*).

Unquestionably, but what does it prove? that the body (the organism) has within it a power which uses the nerves as a conducting apparatus, and that the passage of its energy wears its conductors in the same way as the electric energy will fuse a wire. All energies wear that *through* which they work: by the spectral analysis it is shown the material of the conductors of the fluid are printed on the spectrum. Heat will dissipate the material which presents its effects. Can it then be a matter of surprise that the passage of intellect should wear the conducting media? Were it not for the recuperative power of vital action the machine *would* wither under the impelling energies. What greater proof of the dual fact of man can we have? As man is constituted, cause and effect are commingled. Does it therefore follow that mind is a consequent of the material organism?

Aristotle, according to Bain, speaks of the soul as exercising command. This, he says, "is a familiar enough mode of presenting the relation of the two, but it has no scientific validity. The power commanding is not pure, but embodied mind." Whether we speak of soul or mind, as we conceive them, both are embodied, both are immaterial presentments. If there be a scientific validity for mind, there may be for soul, certainly, if the doctrine of evolution be fact. Each exists and is expressed in the phrase volition. Quoting the professor:

> "Aristotle held the *nous* emanated from a peculiar and select influence of the celestial body, and its own operations are correspondingly dignified. It cognizes the abstract and the universal. It has two modes or degrees on which hang great results. There is, on the one hand, the receptive intellect (*intellectus patiens*), and, on the other hand, the constructive or reproductive intellect (*intellectus agens*). The first perishes with the body, the second, the agens, is intellectual energy in the purest manifestation, separable from the animal body." "*The climax is now reached, logical consistency is abandoned, and there is gained a transcendental starting point for the immaterialism of after ages*" (*italics* mine).

The Cambridge carrier, when asked if his horse could draw inferences, replied, "Yes, anything in reason." Men of genius sometimes have no such gift. The philosophy of Greece was in existence before the era of Aristotle. Pythagoras, Thales, and others preceded Aristotle; Socrates and Plato were his contemporaries. In the sayings of the one and in the writings of the other there is a clear conception of the immortality of gods and men. The philosophical lore of Greece, in the main, was derived from Egyptian sources, and they were of Indian, Babylonish, and Phœnician origin. The idea of immortality was rife in the East in very remote ages, as shown in the Vedás and the Zendavesta, and is inferred rather than asserted in Judaic records. Are we to understand the professor ignored his history for the sake of his hypothesis, or that he undervalues the evidences adduced as their proofs? If Max Müller and those who worked in the same field have rightly construed their theories, if the cuneiform inscriptions and Egyptian hieroglyphics stand for anything, we must conceive man had a conception of spiritual things, and a belief in an immortal principle or soul: the fact is intruded in the earliest historical records.

In verification of the experience of our race through a long past it is asserted there is no proof of unembodied essence. To this assertion is opposed the belief held by the human race through a long succession of ages.[1] There are so-called religious experiences, diabolical experiences, witcheries and supernaturalisms, heroes, gods, and immortalities. Surely that which may be called the embodied testimony of the human race cannot be futile. Science declares the evidences of the senses are not true portraitures. If then the perceptive senses are faulty, where shall we look for evidences, if we are to reject the almost universal belief of man? The material sequences have not the necessary endurance, they vanish into mist; the mirage of the tropics and of the polar regions are phenomena of refraction, and yet appear real. The telegraph wires to a traveller in motion move up and down and interlace, yet are stable and fixed. To perception the mirage is real, the wires move; conception finds the cause of the effect. Our mental facts are the accumulated experiences of all time, and endure wherever culture endures. The testimony afforded by the universality of the so-called religious sentiment cannot be doubted, for it has no paid or interested advocates to vouch for its accuracy, or to thrust it into undesired notice, for, as is said of the wild Arab, it wars against every creed, and subsists only in its inherent universality. It is the pertinent fact of existing man. It has no organized adverse interests busying to present an adverse class of facts. Lubbock (*History of Civilisation*) says, "there is no race of man yet discovered who have not a belief in the supernatural."

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[1] Some philosophers divide all created beings into material and immaterial; the first obeying mechanical laws but can begin no motion of itself, the latter being the cause of all motion. "The immaterial agent is supposed to exist in or with matter, but to be quite distinct from it, and to be equally capable of existence after the matter which now possesses it is decomposed." E. Darwin instances electricity, magnetism, and says, "From a parity of reasoning, the spirit of animation would appear to be capable of existing as well separately from the body as with it" (*Zoonomia*, vol. i, p. 147), and believes "with St. Paul and Malebranche, that the ultimate cause only of all motion is immaterial, that is God." St. Paul "distingnishes between the *Psyche* or living spirit, and the *Pneuma* or reviving spirit," (*ib.* p. 148).

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Unless there be some such principle as the religious sentiment, innate in the conception of man, causation and its consequences, together with the guiding conscience and the continuity of consciousness, wherein must be placed the idea of immortality, constitutes but an idle dream of "the mind's own throwing." There may have been myriads of successive existences, but if we are unconscious of these antecedents, they are as if they had not been. It may be possible that the consciousness of immortality may arise from the shadows of prior existences (the fabled metempsychosis of the past), but more probably it is a precedent principle perfected in thought, by what or from whence, who can say?

"Science discloses the method of the world, but not its cause," and is but the intellectual representation of the phenomena of nature, formulated in the terms of law. When a phenomenon arises, whose tenor does not accord with precedent effects, observation and experiment set to work to find the wherefore of the deviation.[1] When the principle is discovered, it is spoken of as the law governing the facts. Scientifically, laws are but expressions which denote the harmony of phenomena in accord with natural principles, which when disclosed appear to marshal the facts. Probably there is but one force in nature, the variations recognised by science being its conditions, apparently conflicting but harmoniously grouping. Beneath "the web and the woof" of fact, we seek for the cause and associate the idea of power, and in that idea see the antecedent which is found in all effects, and Lange's little wheel is arrived at, itself impulsed, showing force agencies are distinct from material conditions. Moreover, what is more important, we arrive at a factor *without* the thing, unrealized in perception, but which in conception becomes the significance of all facts.

Both the world without and the world within, both that which is perceived and that which is conceived, compel us to look for the reality which exists in each. "It is not the part of wisdom to spurn the lispings prompted by the profound idea that has inspired the faith of man," "the part of wisdom is to excavate that idea from amid the strange incrustations under which it is hidden, to understand its significance, and to estimate its value" (*Anal. of Rel. Faith*, vol. ii., p. 425). Whether we speak of a force, a power, or a spirit, of ultimate cause or of an all-pervading essence, of the absolute, or of a reality beyond phenomena, the terms are symbols of the Supreme, not the Supreme itself (*ib.*). "Philosophy . . is under a logical compulsion to make the same fundamental assumptions as Religion—that of an ultimate all-pervading power, origin, or cause" (*ib.* 425.)

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[1] If anything appears disjointed or thrown in by chance, let the student mark that for contemplation and experiment . . . . and the whole design will stand more fully disclosed (Bell, *Brid. Treat.*, p. 228).

The scientific postulate of the persistence of force, or rather the "conservation of energy," is the expression of the fact that every effect must have an adequate cause; that in nature nothing can be lost, no particle of force can be destroyed, or pass into nonentity. Concentrated forces may be dissipated, and dissipated forces may be concentrated, and one condition of force may pass into another, but the ultimate fund of the power remains for ever unchangeable, and it may be said as nothing is ever destroyed, nothing is ever created, creation being the expression of intelligence perceptively rendered to endure *for all time.* When science speaks of its discoveries as the laws of nature, it simply predicates a constant unvarying force, which is always persistent and consistent, and which under like conditions produces like results. To declare the uniformity of nature is merely to say that the methods of force never change; that it is the same now as it ever was, and will be the same through the eternal æons of time.[1]

The hypothesis of Thomson and Tait, "the degradation of energy," is a denial of the scientific postulate of the "conservation of energy." It is asserted that red stars are extinct worlds. What is the fact? *a ursæ majoris* "has a periodical change of colour, from intense fiery red to yellow, and is sometimes white. The red or reddish hue continues for a shorter time than the white or the yellow. Fading worlds have been likened to cooling cinders.[2]

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[1] Herbert Spencer says (*First Principles*), "By the persistence of force we really mean the persistence of some power which transcends our knowledge and conception . . . . In other words, asserting the persistence of force is but another mode of asserting an unconditional reality—without beginning without end." Amberley says, "Philosophy or reasoned thought and science, or reasoned observation, have both led us to admit as a fundamental principle, the necessary existence of an unknown inconceivable and omnipotent power, whose operations are ever in progress before our eyes, but whose nature is and can never cease to be an impenetrable mystery, and this is the cardinal truth of all religion (p. 423) and of all philosophy."

[2] Lockyer, speaking of the progression of a planetary body, says: "It shines first as a bright star, which afterwards becomes dim and perhaps red, before the state of extinction is reached, to which it must surely arrive—for do not forget that any mass of matter must in time cease to give out heat and light—whether that mass of matter be a coal in the fire or a star in the heavens" (*Science Prim. of Astronomy*).

The dead coal or the *dimmed star*, is merely an altered condition; the coal, ceases to glow through a loss of its combustible principle, but the principle *is*

The experiments of Joule prove where energy appears to be lost it exists in another form. There is no worthless refuse, all reappears, reclothed with its pristine energy. The hypothesis of Thomson and Tait is endorsed by Balfour Stewart as joint author with Tait of the "*Unseen Universe,*" wherein an attempt is made to reconcile the scientific world and scientific facts with the Pauline theology. The authors postulate a God, and on the assumption of a received axiom of science the fabric is reared. Spinoza held that the finite was an outbirth of the infinite, but the authors of the *Unseen Universe* appear, by an inverse mode of reasoning, to assume that because there is a finite world which must pass away, therefore there must be an existing unseen universe; that as this world must pass into nothingness through "the degradation of energy," by the force of continuity, the great principle is manifested, and we are told that because of this because, the Pauline dogmas must be a continuing existing truth, existing in an archetype.[1] In infinite intelligence we conceive a universality, comprising in itself all things, although presented as the *omniscient*, *omnipotent*, and *omnipresent cause,* this probable possible, this existence as God, is only a postulate until His being is proved.

It is insufficient to assert that because all effects must have had an antecedent competent cause, that therefore this cause is Deity. To some minds the statement carries conviction; others accept the facts of the cause but deny its Divinity; others reject all ideas of a creative cause, and refer all phenomenal effects to automatic action, to chemistry, mechanics, and spontaneity; some refuse to

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still an existing quantity, and reproduced through recuperative energy. Either "the conservation of energy" and "the conservation of matter" are the merest hypotheses, or there are neither dead particles, dead worlds, degraded energy, nor wasted heat.

[1] Attempts to reconcile Theology with Science never succeed, we only get Dogma which postulates Deity, and the material aspect of a boundless idea culminating in motion. If the great continuity is to be sought in material bases fruitless indeed is the faith founded on creeds. Were there no unseen universe the continuity of worlds would be preserved as existing in the idea, the vitality of which thrust them into being. If the earth were resolved into its primary, yet as a particle of the universe its continuity would exist whilst one particle of its substance floated in space. The spectrum analysis leads to the conclusion that galaxies and astral systems, suns, planets and meteorites are of analogous composite substances, and if all were resolved into that from whence they evolved the continuity would be unbroken so long as that primordial principle existed. If the universe be the expression of the primordial intelligence objectively presented, then in that intelligence is to be sought the bond of continuity. Worlds, suns, and systems, may fade into nothingness, yet in an unbounded consciousness the creative continuity would be for ever continuing. It requires great imagination to conceive that because there is an existing material world that therefore there is an existing, to us, *unseen material universe;* at least such must be the confession if we accept the assumption of type and archetype as a theological hypothesis.

argue, and are satisfied with the conclusion that if there be a God there is no manifestation of His Providence, and that if He exists He is "unknowable, unthinkable, unfathomable." He may be all these, and although this ultimate conception may be undemonstrable by finite reason it yet may exist, and all our ideas be but the reflex of creative thought. In the design and purposes of nature, in the causative intelligence expressed in phenomena, faith finds both a God and a Providence. All men more or less idealize their conceptions. The physicist considers his conception as the summation of facts, and as an idealization of his dream finds the basis of all things in "eternal matter." The theologian in his conception idealizes the human until it becomes the divine, and on human attributes founds his ideal of Deity. These conceptions are idolisms. The true idealization is that entity of thought expressed as the Religious sentiment, engendered by the personation of the impersonal self, conceiving Deity as a Providence, a fact and a purpose, existing in the supersensual as the præter-natural,[1] an unembodied entity, with neither attributes nor parts, perfected in its own perfection, not as an idol, but as an idealization, infinite and beyond the finite conception.

The ancients supposed they could unfold the processes of nature by reason only. Imagination had its fling, and for elements they had earth, air, water—all compounds, and fire as destroying and purifying. Hooked atoms and other incongruities held the place of chemical affinities, and Physics became a string of ingenious speculations. We can never by scientific analysis know how the kosmic ultimate became objective;[2] how the germ

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[1] "Let us acknowledge the præternatural is not the supernatural, and that whether the præternatural is present or absent, the supersensual, the true supernatural, may and will remain unshaken, and what is supernatural?" "It has come to be recognised the supernatural elements of religion are those which are moral and spiritual" (Dean Stanley, Aberdeen, 1877). The supersensual and the supernatural both imply something above and beyond sense, effects. All facts of abstraction are supersensual, but not supernatural. We know phenomena by perception, we know intelligence, or cause, by conception; as both exist in phenomena, supersensual in the phrase supernatural does not lift us beyond cause and effect, as they are known in nature. When we arrive at an abstraction we apprehend the *Præter-Natural*, or as the better word would be, the super-mundane. *Præter* is over, above, more than, by the side of, near to, and also contrary to, or against, before. Hence we may say our apprehension of Deity, because it is above, over, more than nature, is Præter-Natural, and we may even say contrary to, or against, or before, as in the relation of cause and effect; thus Præter-Natural would stand for the cause, or creator, or the caused and cause combined.

[2] *Germ Formation: The Ideas of Garrod, Sanderson, Thomson, and Tyndall.*

Garrod (Royal Inst.) said in respect to amœbiform bodies (*Amœba*, *Foraminifera*, &c.), the protrusion of fine filaments (pseudopodia) is really a temporary growth, and not, as generally supposed, a search for food, as the nutrient particles are in solution in the water, and furnish the materials for the by the most simple variations multiplies itself, as it would seem, in mathematical progression, almost realizing the Pythagorean notion of number; how the first simple living spot became the lofty tree, or the grand organism, the human form; nor whence nor what is that vitality by which all these changes have been wrought; nor how the first conscious sensation becomes conscious instinct; nor how an idea multiplies, yet unifies itself, until it becomes an abstraction. We know the constituents of the simple spot; we see the *ovum* and the cell; we see the tree, the lichen, and the fungus; we can verify an enormous variety of forms, and when this is done we fall back on its first expression, the life-bearing plasma. We see the falling body, slow in its originating motion, a moment, and its velocity is such that no

growth of the amœba, and when the supply ceases growth ceases, and death ensues. Thus he explains it:—"If an amœba be surrounded equally by nutrient fluid the outer portion is well nourished. The inner part is less well nourished, and the activity of this, the nucleus, is simply the result of motion towards nourishment. In the case of the amœbæ which have shells, such as the foraminifera, the salts of lime are deposited by simple chemical precipitation (as illustrated by putting a hank of wool, soaked in turpentine, into a jar of chlorine). Turpentine is simply carbon and hydrogen. The hydrogen united with the chlorine, and solid carbon was precipitated. The salts of lime which form shells and the bones of the higher animals are," he seems to consider, "all due to precipitation through chemical action around the amœbiform bodies." "The blood of amœbiform bodies may also be studied in the same way, and may be called physical rather than vital."

If the physics are the methods by which vitality assimilates her materials, to call it physical seems very like saying vitality exists and that it does not. Mechanics are methods of formation, but the antecedent is intelligence, and so the physics are modes, but the antecedent is vital action. The terminology does not rid us of the reality!

Burdon Sanderson says:—"Wherever those chemical processes go on, which we collectively designate as life, we are in the habit of assuming the existence of anatomical structure. The two things, however, although concomitant, are not the same, for while anatomical structure cannot come into existence without the simultaneous or antecedent existence of the molecular structure which we recognise as living, the proof is at present wanting that the vital molecular structure may not precede the anatomical. At the same time it must be carefully borne in mind that there is no evidence of the contrary."

Alan Thomson (Brit. Ass. Plymouth, 1877), says:—"*We are just as ignorant of the mode of the first origin of the compounds of the inorganic elements as we are of those of living matter.*" "No student of embryology (in the present state of science) can escape being an evolutionist. No one could say that the development of the individual in the higher animals does not repeat, in its more general character, as in many of its specific phenomena, the development of the race, and in some respects we cannot refuse to recognise the possibility of continuous derivation in the history of the origin of both plants and animals, however we may fail to realize the precise chain of connection." *He appears to reduce the mystery to the smallest possible dimensions—to assume a germ, and construct the whole series out of it* (*The Times*).

speed can overtake it; we are conscious of an idea, but we are not conscious how the idea becomes a thought. Internally we know we are thinking men; we can dwell on the diversity of thoughts, not alone those of our own experiences, but can collate those of others, and perforce we are forced back on the unit, the idea. The idea, the increment motion, and the plasma spot, are each units, and by an interchanging multiple they become magnitudes. Here scientific analysis ends, and Malpighi's littles are resolved by causative intelligences.

The last sentence of Laplace was, "What we know is little, what we are ignorant of, immense." Of the same character was the utterance of Newton, who said, "I do not know what I may appear to the world, but to myself I seem only like a boy playing

Burdon Sanderson's theory was attacked by Tyndall. The difference between them appears to be the sense in which the words germ and structure are employed. Sanderson holds, "the corpuscules are evidently organized; that they resemble in every respect the germs of the lower organisms, and differ from each other so much in volume and structure that they unquestionably belong to very numerous species." Such are the germs of M. Pasteur. In Tyndall's sense they are not germs but finished organisms; "yet it was of these that Pasteur said that it was mathematically proved that they *were the originators of the organisms* which are developed in albuminous liquids containing sugar when exposed to the atmosphere." There are many things which, if inferences are to hold, when argued in extremes become absurd, *e.g.* to say that the characteristic structures of nerve, of muscle, or of gland, exist in the *ovum* at the moment after impregnation. From the moment it is supposed structure means anatomical structure, the argument used by Tyndall loses all force. He (Tyndall), after referring to the germ, says, "some of those particles (atmospheric) develop into globular bacteria, some into rod-shaped bacteria, some into long flexile filaments, some into impetuously moving organisms, and some into organisms without motion. One particle will emerge as a *Bacillus anthracis*, which produces deadly splenic fever; another will develop into a bacterium, the spores of which are not to be microscopically distinguished from those of the former organism; and yet these undistinguishable spores are absolutely powerless to produce the disorder which *Bacillus anthracis* never fails to produce. It is not to be imagined that particles which, on development, emerge into organisms so different from each other, possess no structural differences. But if they possess structural differences they must possess the thing differentiated, viz. structure itself." Sanderson says in the definition he has overlooked the distinction between anatomical "observation and molecular structure." Of germinal particles of "ultra microscopical minuteness" we know nothing (although such particles exist) nor of their structural attributes or their development; nor can it be held there is any connection between "molecular limit" and "microscopical visibility." In speaking of disease germs, he says, "It has been found that ordinary *bacteria* may be introduced into the blood of healthy animals in quantities, without disturbing the health. The danger of the morbific action of the atmosphere arises from their having been infected by miasma or contagium. The statements which Tyndall (1876) characterised as incautious had been, two years before, confirmed by experimenters of acknowledged competence.

on the sea shore, diverting myself in now and then finding a smoother pebble, or a more peculiar shell than ordinary, whilst the vast ocean of truth lays open before me." (*Powel's Nat. Phil.*)

Herbert Spencer says (*Essays*, vol. i, 407), "There is a warrant higher than that which any argument can give for asserting an objective existence, mysterious as it seems—the consciousness of something which is yet out of consciousness." If the something which is yet out of consciousness be an idealization, the idealization exists as it is formulated in consciousness. Although the subject of the idealization may not exist in conscious knowledge, the thought which discloses consciousness exists in consciousness, and is an image of the mind as positive in its presentment as an image thrown by objective phenomena. What, then, can Spencer's "something outside of consciousness" be but the *presiding essence* which we cannot define, however we may think it?

CHAPTER V.

FAITH.—RELIGION.—IMMORTALITY.—SOCIOLOGY.

VIRCHOW, in his address at Munich, assumed a prominence for belief. Belief is faith. Faith may be a reasoned or an unreasoned conclusion. Its postulates taken for granted the consequents flow in seeming sequences. When reasoned premisses are assumed as a basis, whether true or false, the acceptance of the theory is exactly in accord with the mental condition, and its inception presupposes its truth. The basis may be mere authority (*i.e.* unreasoned); it may arise from the conception of a creative cause, with an ideal so extended that it is clothed with attributes which may be imaginative, or springing from a given bereasoned consequents, or be so utterly inconsequential as to be wholly improbable. Whatever the idealization may be, and however arising, it constitutes the real elements of faith. Whatever variations may arise, the broad principles exist and become a conscience in consciousness. Whatever are the inconsistencies of the thought or the changes in its condition the conception remains unchanged. The same principle which induces faith in imaginative theories has its place with science, where there is much of the speculative, there is too little of the proved. No man knows all sciences, their bases are presumed to be established; when weighted by a name a faith in them is formulated, perhaps in turn to be shattered by a balance of probabilities. Theology and Science, presumptively, are reasoned conclusions: on the one hand, a theoretical God, on the other hand, theoretical Matter, but neither can be presented with the precision of evidence. The ruling principle in each is the same, whether it be dogmatic presumption or scientific assumption. In this view materialism[1] may be as much a faith as the most exalted moral code, or the most transcendental theology, or the most mystical idealism.

Words present difficulties, and as are the peculiarities of thought so are the distinctive meanings they convey. Ask a dozen men to define civilisation, the definition would be different with each. Sharon Turner's is "Political order, social courtesy, pleasurable amusements, and domestic employments;" Guizot's, in its abstract principle, is perhaps the more correct, "The development respectively of social and individual activity, as marked by two signs, the improvement of man's outward condition, and the improvement and development of his faculties." Max Müller (*Science of Language*) recognises the difficulty. He says, "A history of such terms (among others, the 'finite and infinite') would do more than anything else to clear the philosophical atmosphere of our days." Berkeley struggled with the same difficulty. Max Müller says:

> The infinite, we are told, is a negative idea, it excludes only. "We are assured in the most dogmatic tone that the finite mind cannot conceive the infinite." "There is no infinite, for as there is a finite the infinite has its limits in the finite," and "cannot be infinite." "It is negative because the negative particle *in* is used." "The same idea may be expressed by the Perfect, the Eternal, the Self-existing." Here is no negative idea: that negative words may express positive ideas was perfectly well known to the Greek philosophers. The true exposition of "the finite" is "the shadow of the infinite." Whatever may be the etymology of "finis," it stands for something "which the senses do not supply," but "has an existence in the language of reason." We "have besides reason two other organs of knowledge, Sense and Faith; "neither subordinate to the other," but "co-equal." "Faith is that organ of knowledge by which we apprehend infinitude." "The infinite hidden from the senses, denied by reason, is conceived by faith underlying the experience of the senses and the combinations of reason. What to our reason is negative, *in-finite*, becomes to faith positive"—the "infinite," and "if our eyes are once opened we see even with our senses straight into that endless *all* by which we are surrounded."

The external senses apprehend the finite, as being in their own nature limited, and reason arranges and organizes that which the senses present, terminating in consciousness, but this is a consciousness of reasoned results based on observation and experiment. The element Faith gives another aspect to the argument, and opens out another channel, another consciousness, that of the innate interior consciousness. "The religious sentiment" is that which conceives infinitude, or "self-existence eternally prolonged." The perceptive mind is bounded by its own sources of information, and cannot rise higher than its source. Faith shows a higher source. There is a perceptive faith, based on facts, evidences, and authorities, and a conceptive faith, which grasps the Unseen. It is by faith only the unseen can be appreciated. Reason leads to its confines, and faith, enforced by inductions drawn from phenomenal nature, leaps the chasm, and in the unseen finds the factor to which the existing harmonies of nature are due.

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[1] If a profound argument for materialism were required it may be found in Berkeley, but able as is the structure raised, he meets it by an argument equally able: refutation.

By this action of faith we receive the consciousness of a higher self—of an interior something existing with, yet not of the environing substance. By an induction we associate the mind and the unseen power, visible only by its effects, with that other intelligence also unseen, but predicated only by results. Then, being associated by their affinities, an influx is established, recognised by the religious sentiment, and in faith is constituted an invisible existence, to the inner consciousness unbounded. Congregated in faith by the religious sentiment, the belief of a spiritual kingdom existing in the unseen is embodied. Thus the ideal of the idea presented in language means, "the Eternal, the Perfect, the Self-Existing," the Infinite, the Everlasting, whatever the phrase may be, all are embodied in the Saxon word—*comprising all being*—God. In this idea there can be no limit, nor can a secular principle be connected with it.

Science and religion are easily reconciled. It is but to accept the facts as they are condensed in consciousness and asserted by conscience; then all we know of this world and of the universe appears as one thought, an idea of extended vastness, comprised in one universal intelligence.

Martineau has asked, "What indeed have we found by moving out of all radii into the infinite? That the whole is woven together in one sublime tissue of intellectual relations, geometrical and physical, the realised original of which all our science is but a practical copy. . . . . Unless, therefore, it takes more mental faculty to construe a universe than to cause it, to read the book of nature than to write it, we must more than ever look upon its sublime face as the living appeal of thought to thought."

We see a thing and infer the existence of something external to ourselves. The presence of the sensations is conceived to be an adequate warrant for asserting the presence of their cause.

Precisely in the same way we feel the presence of the Unknowable being, and "because we feel it we infer the existence of a real object both external to and within ourselves. The presence of the emotion is conceived to be an adequate warrant for asserting the presence of its cause." "The object of the sensations and the object of emotion might be illusory: this is conceivable in logic, but not in fact. There can be no reason for maintaining the unreality of the emotional and the reality of the sensible object. Existence is believed in both instances on the strength of an immediate intuitional influence." The mental process is active in each; and "if it be contended that sensible perception carries with it a stronger warrant for our belief in the existence of its objects than internal feeling, the reasons for this contention must be exhibited before we can be asked to accept it, otherwise it will turn out to be a pure assumption, constituting, not a reason for the rejection of religion by those who accept it, but a mere explanation of the conduct of those who do not." "The denial of religion is not the less emotional than its affirmation;" and when men "quit the emotional stronghold to speak of those to whom that unknown cause is perceptible, as the victims of delusion, these latter may confidently meet them on the field which they themselves have chosen" (vide *An. Rel. Faith*, vol. ii., p. 477.)

Max Müller says, "True reverence does not consist in declaring a subject, because it is dear to us, to be unfit for free and honest inquiry. . . True reverence is shown in treating every subject, however sacred, . . with perfect confidence, without fear, and without favour . . but before all with an unflinching and uncompromising loyalty to truth" (*Science of Rel.*). "He who wants to find out what religion is, what foundation it has in the soul of man, and what laws it follows in its historical growth, . . the study of error is to him more instructive than the study of truth, and the smiling augur as interesting a subject as the Roman suppliant who veiled his face in prayer that he might be alone with his God" (*ib.*). "If we say that it is religion which distinguishes man from the animal . . we do not mean any special religion, but we mean a mental faculty which, independent of, nay, in spite of sense and reason, enables man to apprehend the infinite under different names and under various disguises;" and "when man turns his face to heaven certain it is that he alone yearns for something which neither sense nor reason can supply" (*ib.*).[1] "The highest morality that was ever taught before the rise of Christianity was taught by men with whom the gods had become mere phantoms, who had no altars, not even an altar to the Unknown God." (*ib.* 143). (*Buddhists*). (This dictum is more than questionable in the face of the teaching of the Vedic hymns and the Zend-avesta.)

Religion in its origin lies in a small compass: "A few words recognised as names of Deity, a few epithets which have been raised from their material meaning to a higher and more spiritual stage," "words which originally expressed bodily strength, or brightness, or purity, came gradually to mean greatness, goodness, holiness," and eventually more technical ideas. The word explaining breath, as *Psyche* among the Greeks, represents life, spirit, mind. The same idea is found in the Sanskrit *Atman*, which eventually became the self. The Spaniards in their earliest visits to Nicaragua found it in the Aztec word *Yuli* (to live), having the same significance as *psyche* and *atman*. The Aztecs believed that when a person died in battle he went to the gods, and also when he had led a good life; otherwise the yuli perished with the body. There goes forth from the mouth, they say, a something resembling the person (yuli). The same thought is found among many uncultured nations. With the Zulus, *Uthlanga*, a reed, metaphorically, is the source of being, the original meaning being lost. Everywhere we find the ghost, spirit, or shadow, as a perceptive embodiment of the conceptive thought, the mythic expression of the religious idea, that the man exists although the body dies.

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[1] The watch cry of the men of the day, that is, "Nothing exists in the intellect but what has before existed in the senses," is answered by the epigram of Leibnitz. "Yes, nothing but intellect."

The link of thought expressed in words is found when the Greek says *es-ti*, he is; the Roman *est*, the German *ist*, the Slav *yesti*, the Hindu *asti*. The Sanskrit word is a compound of the root *as*, to be, and the pronoun *ti;* the root originally meant, to breathe. We may then gather from language and mythology that each accent had its original meaning, and each myth a history (vide *Phil. Mythol.*, Max Müller). Words are not alone expressions of thought, as by originating ideas they frequently engender them.

Blackie contemns the attempts to explain mythology, even under the guidance of a Bopp, a Grimm, or a Max Müller; yet by their labours, and those of Cox, a meaning has been given to seemingly unmeaning legends. If they have done no more they have knitted world-thought with world-thought, and in tracing these myths to their roots have shown how the dawning mind of man allegorized nature, idealizing the perceptions by a conception of the Divine. This idealization occurred not alone among the Greeks and the Hindus in long-past ages, but all nations in the dawn of a faith have done the same. However distant or barbarous, the same strain of thought, and frequently the same images, are presented in their legends. India, Egypt, Mexico, have the same myths in their religious rites, with festivals regulated by the same stellar signs; but wherever the Aryan has placed his foot the similarity in derivative customs is greater, disclosing in mythic guise, a common origin. The distinctive character of the sentiment prevailing with all peoples goes further to verify the kinship of race[1] than the similarity of speech and of customs.

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[1] The Hottentots have a beautiful myth of the moon sending an insect as a messenger to man. "Go thou to men and tell them, as I die and dying live, so shall ye also die, and dying live." "The insect deputed the hare to deliver the message, who rendered it, the moon says "As I die, and in dying perish, in the same manner shall ye also die and come wholly to an end." The moon in anger split the hare's

Flood legends can be gathered all over the world; no race is without them. Taking into consideration the distinctive attributes of race, they appear to be the narrative of the same incident. With all races is the same idea, the symbolising the unseen.[1]

Whatever the position of man, his dual nature pertinently speaks in all his conclusions. The physicist by perception continuing the action of his elements pronounces for material causes. The philosopher, whilst contemplating the principles by which the elemental substances cohere, combine, and change, whilst accepting the analysis, unearths the principle, and by a conceptive induction idealizes his theory, and finds beneath the moulded substances an intellectual organizer. Uncultured man finds an explanation of nature in his superstitions, and extends his ideal into the unseen.[2] Civilised man founds on his superstitions his ideal and centres his hope on an imaginative given. The natural philosopher, viewing nature as a whole, divines a cause, nameless in his thought, and because nameless and undefined, he hypothecates an origin whilst awaiting his proof. Thus the uncultured, the cultured,

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lip, continuing to this day; in revenge the hare scratched the moon's face, and the traces continue. We have here a conceptive philosophy perverted into a perceptive distinction.

[1] Plato aptly depicts the thought. "He will reason that the sun is he who gives the seasons and the years, and is the guardian of all that is in the visible world, and in a certain way, the cause of all things which he and his fellows have been accustomed to behold."

In the *Natural History of Religion*, Hume says, he would show himself but little acquainted "with the ignorance and stupidity of the people" who thought "the doctrine of one supreme Deity" owed its success to the prevalent force of reason. In this day, in Europe, ask one of the uncultured why he believes in an Omnipotent Creator? He "would not hold out his hand and bid you contemplate the joints in his fingers, the counterpoise they receive from the thumb, the softness and fleshy part of the inside of the hand, &c., which renders that member fit for the use to which it was destined." "He would tell you of an unexpected death, a bruise, drought of the seasons, or cold, rains, and of such events . . . . as are the chief difficulties (in reasoning) to the admission of the idea of a supreme intelligence, but which to him are the sole arguments for it" (*ib.*, p. 42).

[2] The savage man lives and believes much in his own instincts, and quite accords with the idea of the Latin poet, "that life could not be worth more than the pleasure which renders it desirable." This feeling seems incorporated in his ideas of a future state, and they consider the next life to be a continuation of this. The redskin hunter hoped to be translated to a region abounding in game. The Maori believed that life after death is a series of skirmishes in which the blessed are always victorious. The Teuton of old nourished the same hope. Civilization cramps such aspirations. Would the cotton weaver be content to labour for ever in cotton mills, although they were miles on miles in length, or the wearied field hand be content for ever to dig, or the denizen of London for ever to live in the smoke and turmoil of an exaggerated London?

The Indian sage believes in metempsychosis. Figuier would hang its fetters on the cultured mind. The climax of his philosophy is that the perfected souls of men energize the sun; this idea competes with the most ultra of psychological wonders! And yet it is said a distinguished astronomer entertains a similar idea.

and the philosopher, have faith in the same unknown fact, impersonal, unfathomable, and indefinable.

In maintaining man's immortality *i.e.* the eternal or ever-living persistence of an immaterial essence, we pass into the supersensual, adducing the prӕternatural, thereby making the insubstantial the consubstantial. By experiment it is shown that elemental substances are in being when they have passed from perception, also that forces imponderable and immaterial are present, although unseen, existing in matter yet unembodied, presenting effects, using matter as the vehicle to make their display. All that can be said of the imponderable forces may be said of the spirit or essence of man. The imponderable forces are individualized in their principle, as the intelligence, soul, or essence of man is individualized in the Ego or self. If we only accept the seen, little indeed were our knowledge; perception knows nothing of evaporation, the ice is watched, it falls into water, or is dissolved into mist.[1]

The perceptive is one phase of man, and it assumes the symbol as its fact; another phase is the conceptive or intelligent and reasoning; through this the elements are re-collected and condensed, and from which the gases, liquids and substances are made to emerge. In the region of perception mind is the shadow of substance. In that of conception, mind is substantial and real, an immaterial entity existing in its own principle. We cannot put a thought into a crucible and bring it out a substance, but in its symbol it can be presented as a fact. Perception and conception, judged by the same rule, find their facts in effects. No natural element can be erased from existence, it exists in its ultimate, and by the recuperative powers of nature is presented again as an effect. By a parity of reasoning we must say that mind, in its ultimate or essence, can neither be annihilated nor obliterated. Can it die?

If we go to theologies the teaching is of an immortality, but it is an immortality of the senses, for there are pictures of torments and suffering.[2] This was the prevailing opinion of the old

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[1] An isolated block of ice, although surrounded by frost, will imperceptibly vanish by evaporation. (Vide *Maxwell on Heat*).

[2] Farrar says he does not hold "the Romish doctrine of Purgatory," "but it is not to be confused with the opinion of many of the fathers that there is some intermediate state wherein souls which, at the time of death, are still imperfect and unworthy and not yet in a state of grace . . . . may still be reached by God's mercy beyond the grave." (*Eternal Hope*, preface, p. xx.) Farrar, in continuation, says, "the statements . . . . that *I denied the existence of Hell, or denounced the doctrine of eternal punishment, are merely ignorant perversions of what I tried to teach*" (*ib.* xxi). "There are four elements in the current opinion which I consider to be unsupported by Scripture." They are—"1. The physical torments, the material agonies, the *sapiens ignis* of eternal agonies. 2. The supposition of its necessarily endless duration for all who incur it. 3. The opinion that it is thus incurred by the vast mass of mankind. 4. That it is a doom passed unreversibly at the moment of death on all who die in a state of sin" (*ib.* xxviii). If this be not a denial of eternal

Fathers, delineated in the parable of Lazarus and Dives, and enshrined as a dogma by the Church. Religion is the acknowledgment of an existing, unseen, and præternatural power; its inculcations moral conceptions,[1] in its unity and universality a concentration of sentiment, intelligence and mind, and as an idealization, God the Creator. The Greeks took the expression of beauty as their kosmos, concentrating in the word the harmonious relations of phenomena. Symmetry is an outbirth of sympathy, as constituting a Providence, thus the kosmos in its element beauty, becomes centralized in universality.

It is possible the theologies of the world are symbols of the science of their eras, and the science we know and have, probably existed in a long forgotten past.[2]

Philosophy, or reasoned thought, and Science or reasoned perception, admit of, as a fundamental principle, the existence of an unknown and omnipotent power. Experience cannot be appealed to as asserting an infallibility, and observation is frequently misleading. It was asserted as a fact of observation, none more unhesitatingly, none considered more settled, than that the pulsations of the heart occurred in all animal organisms in one mode

punishment words have lost their significance. A doctrine of the Anglican Church is founded on the parable of Dives and Lazarus, Luke xvi, v. 24. It will be comforting to the abused spiritualists to find they are not such ignorant dolts as they are pronounced to be by Dr. Carpenter, who *in pure ignorance of what was inculcated and believed in by them* vented his vituperations, when their ideas are upheld by so accomplished a divine as Dr. Farrar. Our *professors* may now indulge a materialistic terminology, deny the intendence of their words, and so escape the charge of materialism!

[1] Zeno (564 B.C.) insisted that culture was the true foundation of virtue. We must trust to sense to furnish data of knowledge to be condensed by reason; that nature aims at the universal, hence individuals are the means by which her ends are accomplished; that everything around us is in mutation, decay follows reproduction, and reproduction decay. The cataract preserves its shape but its waters are perpetually changing—this is the aspect of nature. The universe as a whole alone is unchangeable. He doubted whether the mind can ascertain absolute truth.

[2] The researches of Layard in Assyria have disclosed great advances in art. At Kougunjik, the scene of the late Mr. G. Smith's researches, ruins of edifices and a literature, which had existed more than five thousand years before the Christian era, have been found; also elaborate designs in sculpture, drawing, engraving both in relief and surface cutting, executed with a fineness of touch which demonstrated high attainmants, glass bowls, enamelled bricks in all colours ornamented with flowers and scrolls, fragments of earthen vases, with figures so highly glazed as to have assumed . . . . the iridescence of ancient glass, bronzes inlaid with gold, one of which is the Egyptian *sacred scarabæus* with extended wings; bells formed of an admixture of brass and tin, modulated in cadences, chairs formed of ivory, copper rings, &c., the arch wanting in the Egyptian, early Grecian, and Roman architecture; the lens of rock crystal with opposite convex and plane facets, pointing to optical instruments (as does the tube of the Druids. Diodorus). We have at least the true microscope in a simple form, buried even before Rome had being, a lost art. In the ages of Pliny and Cicero, a water-filled glass bulb served as a microscope. We have besides the impressions of fixed characters on baked clay tablets, which, as deciphered, disclose histories and philosophies.

Was Babylon the mine from whence Egypt drew her knowledge? and the only. Von Hasselt discerned a variation.[1] When it is found that there is an innate (because universal) conception, according in principle in the minds of all peoples, it may be assumed to be fixed, however inexactly defined, involving no question of necessity, *it is one of being*.[2] The experiential and experimental schools have effected at the least this good, they guard against accepting, as necessary and ultimate beliefs, effects which are frequently contingent and dissoluble. Man cannot escape a faith.[3] Religion, formless in intelligence, postulates its position as fixed and final. It no sooner appears than a formula is instituted, against which it is continually protesting. The attempt is always made to confine it within a set of dogmas. Sooner or later the religious sentiment bursts from the imposed thrall, but awaiting the new advent is another scheme of dogmas. This is the history of creeds in all ages of the world, and it is not the less true "that the deepest hostility to theological systems is inspired by the very sentiment to which these systems seek to give a formal and definite expression"[4] (Amberley).

columns of Hermes but the rescript of an older era? The pyramids of Gizeh (according to Piazzi Smyth) show there were adepts in astronomical lore. The Chaldeans were noted as astronomers and workers in occult arts. The temples were their treasuries of knowledge; the tile-records, recopied in Assyria, show an advanced civilization, founded on philosophy and commerce, for amongst them were found trade accounts, and if those records be as old as the flood legends written on the tiles, we have records of an advanced civilization preceding the time of Jacob, if not that of Abram. The Chaldeans are famed in history as being deeply skilled in science, and by the tiles we are assured their fame was not an idle romance. In the time of Alexander, Berosus gave the mythic histories of Babylon, which, until the discovery of the Assyrian ruins, were doubted by the learned, if they were not rejected as impostures.

[1] Up to 1824 it was supposed of every animal possessing a circulation, "that the current of the blood took one definite and invariable direction. In 1824, "Von Hasselt, happening to examine a transparent animal of a class (*Ascidians*), found to his infinite surprise that after the heart had beat a certain number of times, it stopped, and then began beating the opposite way, so as to reverse the course of the current, which returned by and by to its original direction. I have myself timed the heart of these little animals; I found it as regular as possible in its periods of reversal" (Huxley, *L. S.*, p. 86).

[2] Huxley says with the "relative merits and demerits" of Fetishism, Polytheism, Theism, Atheism, Superstition, or Rationalism, he has "nothing to do". . . ." "but it is needful to say that if the religion of the present differs from that of the past it is because the Theology of the present has become more scientific than that of the past" and "because it begins to see the necessity . . . . of cherishing the noblest and most human of man's emotions by worship, 'for the most part of the silent sort,' at the altar of the Unknown and Unknowable" (*ib.*, p. 16).

[3] Hume says: "Could any statuary of Syria, in early times, have formed a just figure of *Apollo*, the conic stone, *Heliogabalus*, had never become the object of profound adoration" (*Nat. Hist. of Rel.*, p. 39). This fetish, was it the debasement of the religious ideas or the perpetuation of a tradition?

[4] "The little spark of awakened human intelligence shines so mere a speck amid the abysses of the unknown and unknowable, seems so insufficient to do more than to illuminate the imperfections which cannot be remedied, the aspiration.

Man is most familiar with physical substance and sense expressions, and assumes a reality for the facts within his experiences, whether they be of uniformity, harmony, power, or beneficence. With all these ideas there is something outreaching experience, as beyond and without the bounds of man's being, or as too lofty and great to be held steadily before the mind: the ideal may merge in symbols and be prostituted to sense or may exist as imaginative contemplations. All formulated creeds gather their complexion from the habits and instincts of the people amid whom they originated; this is the peculiar aspect of Judaism, and the personal character of the God portrayed. The idea embodied is but an enlarged representation of human thought, connected with a power beyond the human, the spirit which speaks in and through us; in whatever words the ideas of God are framed, they are "but symbolical of the supreme," and "not the supreme itself," disclosing a being whose nature is clothed with a mystery which no perception can pierce, no conception can fathom. Between mind and matter, between spirit and body, between life and substance, between internal and external phenomena there lies the gulf which neither science nor metaphysics, but faith only can bridge.

Kant calls time "one of the forms of sensibility," Schelling holds "it is pure activity with the negation of being," Leibnitz, "the order of successions," as he defined space to be the order of existences. Newton and Clark make space and time attributes of Deity.

Flammarion has a curious exposition of time and space. He argues:

> Neither time nor space are realities. The only realities are Eternity and Infinity; with them there is no beyond, no sides, no lengthening line. Everything is relative. The ephemeris in its seconds of time lives hours. As are eras to eternity, so are days to man. A line is a length for ever proceeding; join the ends in an ellipse or a circle, and there is neither beginning nor end. We only conceive space by imagining another space, and time but as an interval between space and space. We exist in time, we dwell in space; therefore to us they are positive quantities; it is the relativeness of thing to thing which creates distinctions, and these distinctions are our world of effects.
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> Time is the measure of the motions of the earth; if the earth did not move we should have no record of, and thus no consciousness of, time. The astronomical idea of the church was a motionless earth. "The Fathers said, at the end of the world the diurnal motion would cease, and there would be no

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which cannot be realised, of man's own nature. But in this sadness, this consciousness of the limitations of man, this sense of an open secret which he cannot penetrate, lies the essence of all religion; and the attempt to embody it in the forms furnished by the intellect is the origin of the higher theologies" (*L. S.* p. 12).

more time." Had the earth been, as supposed, an immovable flat surface illuminated by a sun immovable at the zenith and by an invariable diffused light, no moving shadow would have been possible; nothing which could have been divided into days, hours, or minutes. Again, suppose the earth turned twice as fast on its axis as it does, around the sun, then the eras would be doubled; a man of sixty would but have lived thirty of our years; or even if the motion were ten times as fast there would be the same seasons and days, only occurring more rapidly. Other celestial motions following in the same order, there would be no change perceivable. Again, microscopical animals, which live but a short period, and perform all the necessities of their organization, they in proportion too have, it is to be supposed, an appreciation of life as profound as ours, yet their measure of time would be different. All is relative; a life of a hundred years is not longer than that of another organism completed in a few minutes. It is the same with space. Earth has a diameter of eight thousand miles and upwards. Suppose it diminished to the size of a marble, and all its components underwent a corresponding diminution, our mountains as grains of fine sand, the seas a drop, and we small as microscopic infusoria, nothing would have changed for us; we should still have had our regulated dimensions, and the earth would have had its exact relations. "A value that can be increased or diminished at pleasure without change is not a mathematical absolute value." In this sense it may be said neither time nor space have any existence. If we were in pure space, what time should we find there? Whatever period we remained it would be the same. Each planet, in fact, makes its own time, and where there is no planet or anything answering to it, there is no time. Thus Jupiter's years are twelve of ours, and his day only ten hours; Saturn's year is thirty of ours, and his day ten and a half hours.

The history of the universe is the eternal secret; our notions of time and space are the successions which befall our planet. Our perceptions assume its complexions, and they are registered in eternities. In perception there is time and space, in conception neither, for there is no possible beyond conception when exhibited in consciousness; no circling sides, no lengthening lines. Time and space are mutually perceptive, but are never objectively presented, and their relativeness is only arrived at through changing phenomena. Were conception unembodied, conceptive facts alone would be perceived, these facts would be thoughts rendered objective as phenomena. Thus, if the principles by the application of which phenomena arise were alone present in the mind, conception would then be as spirit, the conception of the spirit would be embodied, and phenomena would still surround the unembodied spirit, but to it there would be no *objective persistence*, form only would be present, and all phenomena would be merged in the spiritual ideal. It would be the same with creeds as with substance. The spirit would exist in the ideal it created, guided by the indwelling sentiment to recognise that which was the cause of its origin, foreshadowing the community between the perceptive and the conceptive. The perceptive may be ultimate in the order of the perceived, but the ultimate of conception is hidden. To man there are two presentments—organized forms as vehicles, and mind as intelligence or spirit. What either is we do not know. In the undiscovered yet to come, they may be found to be diverse presentments of one principle, existing unembodied as spirit, intelligence, or essence. We know what they are not, however material views may attempt to confound them. In the argument for the immortality of man it has hitherto been assumed that spirit is a quality or principle existing with an organism, but distinct, the two constituting man, the organism being but the vehicle by which the spirit power is displayed. Assuming (but which in no sense is conceded) that matter is alone the self-existing principle, the immortality of man, as spirit is equally assured. By the doctrine of evolution,[1] all living organisms through development proceed from the *ovum*, or *plasma spot*, the simple becoming by an ingeneration the compound and complex. The material assumption is that sensation is a property of matter and that through minute and infinite differentiations it becomes mind—graduating through organisms until man is reached. If then sensation be a property of matter, mind by emanation proceeds from matter. Matter being indestructible and therefore eternal all things arising out of it, as its sublimation or spirit must share and possess the properties existing in the indestructible and eternal basis, then mind as the spirit of matter would be eternal and indestructible. Thus we should say that spirit in its immature form would be matter, but in its mature form, in sublimation, would be spirit or essence; in man presented as mind or intelligence. Man is individualised in his intelligence and hence intelligence in its ultimate would be spirit—and this spirit by emanating from an eternal and indestructible basis, would find a continuity in an eternal duration. It is no argument to say that because matter can be dissipated that mind can be dissipated. Matter is not dissipated, excepting so far as our perceptions are concerned, and if it be resolved into gases or ether, principles or essences, it is still an existing and persisting quantity. We can again gather together the elements, but mind, even if it springs from matter, cannot be reproduced in a material form; it exists, as an entity, *not* as matter exists to perception. Thus the existence of mind becomes supersensual, existing as an immortal principle, by virtue of the indestructible basis from which it emanated, existing in its own affinities, and as an entity is individualized. Thus consciousness as an emanation from matter would be a self-existing principle, because as also derived, by sublimation, from an indestructible basis. It then follows that whether we argue that matter is but a formulated thought, and that spirit is the first principle, or that matter is the first principle, and that spirit through development is its ethereal essence, adopt which mode we will, we are assured of the immortality of man in his intelligence. Both modes of arguing bring us face to face with an inscrutable mystery. In the one form the minor proceeds from the major, in the other the major from the minor—a subverting of all principles of reasoning, whatever the fact may be. We may now say, whatever be the position assumed, man's immortality, so far as the reasoning is concerned, is indisputable. If the entity or individualism of the spirit or essence be denied, we should be landed in a species of Buddhist Nirvana, an existing but an amalgamated intelligence. If, on the other hand, the entity is admitted, we have independent, self-governing, and self-controlling spirits or essences.

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[1] Evolution is an equivocal phrase, signifying "the process of evoking or rolling out of something already existing, at least in its elements." Evolution understood as a process of development implies an antecedent. We have no God and all God theorists invoking evolution as evidences of their special hypotheses, and that whether the antecedent or God be personal or impersonal, or whether it be *inert* matter, with or without design, a purposed fact, or a fortuitous concourse of atoms, and with or without an antecedent intelligence. However absurd may be the hypothesis, evolution is made its parent or proof.

[2] "Think of the microscopic fungus, a mere infinitesimal ovoid particle, which finds space and duration enough to multiply in countless millions in the body of a living fly." (*L. S.*, p. 121).

Nirvana in the general idea means annihilation. This the Buddhists deny, and found on the principle a grand philosophy. Their assumption is that as a spirit, man when purified by denials of self pass into the other world, and in a series of existences become spiritual agencies and gods. (Buddhavistas.) It is only when the ultimate purity is attained, a pure and perfected intelligence, that the spirit enters Nirvana, and then becomes amalgamated with the supreme intelligence, existing only in its light and power. In this view Nirvana is an annihilation of the individual consciousness. But if it can be assumed that the individualism is still existing, it is an association of pure intellect with pure intellect, an existing individualism, which, when associated with supreme intelligence, becomes an omniscience combined with omnipotence. (*Vide note* 1, *p.* 113.)

Can the idea of immortality be a phantasy? the idea exists wherever culture exists. No race of man has been discovered who have not some idea of an existence beyond the life they live. With some uncultured races it is the conception of beings formerly inhabitants of earth who return as evil spirits; again, others suppose their ancestors return as spiritual presences, continuing but for few generations; others that there is a forever existing evil spirit, haunting and injuring; others recognise a good and evil spirit, some only a good spirit; with all there is an impression of the unseen; its lowest expression an unformulated superstitious dread. With some tribes there is an evil spirit to be propitiated and an exalted being to be regarded and reverenced as the author of all good (*vide* Lubbock and Tyler). It therefore may be said that the conception of the unseen (spiritual agencies) is universal with man, but it is doubtful whether in all cases the idea of the immortality of man is ingrafted with it.

The consideration then arises—Are superstitions the debasements of a religious faith, or is the idea of the unseen an inborn conception originating with the various tribes with whom it is found? We have then to fall back on the meaning attached to the idea of Immortality, and have to inquire whether it be an innate conception or the result of culture? All formulated creeds have as *an article of faith*, the belief in the immortality of its professors. Whence does the idea arise? The general answer is, that it is founded on a sentiment (the religious sentiment). Is this sufficient? if so the fact is formulated through a mental conception inherent in man and perfected through culture. Accepted as an answer we must inquire in what does it consist? Some answer it is a continuation of consciousness. Animals are conscious, can it be said they are immortal? The answer should be in the negative, because (as far as we know) they have no individualism, as the expression of thought, nor the mental power in its condensation as an abstraction, hence there can be no continuing consciousness, because there is no conscience. In man, in the abstract idea there is an individualism and conscience, as elements and conditions. Is this individualism a continuing abstraction? If answered affirmatively, then man as an individualized intelligence is immortal; if the individualism, being a mental abstraction, is once in existence, it must be accepted as being for ever existing, because it is an intellectual unit, not existing merely as an idea, but because it is interwoven in intellectual conception, itself *a quality* of intelligence.

It can be no phantom thought, because else, it would fade away as wanting in intensity, or be obliterated through the crowding in of other ideas; on the contrary, it is continuing and for ever recurring. We then arrive at the conception of the perpetuation of an existing individualism consciously impressed, hence we have an indefinite idea as to objectivity, but as to subjectivity definite.

This individualism, from whatever source it be derived, is an existing fact in intelligence; even if it be denied that intelligence is other than a material consequent, it still as an ultimate unity would be self-perpetuated, linked with consciousness, a conscious individualism.

Questions of embodiment or disembodiment are merely relative ideas. We recognise the disembodied as an existing quality (*e.g.*), thought. The thoughts of men, dead ages ago, are recorded, and thoughts flow from mind to mind without a cognizable embodiment in substance.

Hegel says, "The interior world, the sentiments, the contemplations, and the emotions of the soul, instead of retracing the development of an action, its essence, and its final goal are expressions of interior movements in the mind of the individual." If it be true that there is no moment in life when we do not (consciously or unconsciously) think,[1] it must be conceded that with organic life there is soul-life; it then follows, that in the continuity of each fact there are separate existences, the material components forming new material components, and that which constitutes soul, through a universality of action, in its individualism is for ever continuing.

Another view of man is the social. On this Herbert Spencer has written an admirable work (*The Study of Sociology*). To be practical its address is to another being than man as he is. The ameliorations of class distinctions are admirably put, but there is a point beyond which the principles cannot go, and that is "the self." The whole philosophy merely discloses the selfishness of man, the legacy of his ancestral descent. The ruling trait throughout animal organisms is the instinctive self; which includes, not only, so-called cultured but uncultured, unprogressed, or savage man. The true exigence of life is the *culture of conscience*, which includes morals and rights. The exercise of this principle extends further than from man to man, it includes the inferior organisms. This was recognised by Buddha. The question is a large one, but may be comprised in a word, DUTY. The principle of its development reveals the dual nature of man, the self and the conscience. The instinct of man is self, developing into selfishness, the root of all wrongs and evils, of all class, social, and theological distinctions. The true exemplification of the higher nature is the overcoming the instinctive self. There are recognised rights in men and in animals other than the self. Self is a necessity of existence, but it is a self which should be so regulated as to recognise there are other selfs in the existing life.

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[1] Kant says, "There is no sleep in which we do not dream, and that it is due to the rapidity with which ideas succeed each other in sleep that constitutes a principal cause why we do not always recollect that we dream." "The mind is never inactive nor wholly unconscious of its activity" (Sir Wm. Hamilton). Bankes appears to have forestalled Kant. He says, "I suppose the soul is never totally inactive. I never awaked since I had the use of my memory but I found myself coming out of a dream, and I suppose that those who think they dream not, think so because they forget their dreams" (*Def. of the Soul's Immortality*).

Society as constituted is selfishness, on the one side endeavouring to control the self of others, and still to exist, independently of the other selfs. To the instincts or perceptions there is no such institution as moral law; and even if social restraint springs from a conceptive sense of right, the selfs are for ever seeking opportunities to evade it. If it were possible to educate men into the moral tone Sociology would be possible, but then it must be an education co-extensive wiıh man. A nation actuated alone by moral law, with conscience as a regulator or administrator, could not exist beside other nations impulsed by a lower ideal, because it would be the prey of instinctive rapacity.

The principle of turn the smitten cheek, &c., is admirably grand as an ethical abstraction, but as a rule of life utterly impracticable. We have the history of this ethical abstraction combined with communism, and what is the record? Those who on this principle instituted a theology, first abrogated the communism, because self for selfish purposes abstracted the aggregated funds. This sect, whose principle of constitution was to suffer wrong for the sake of its principle, became the most selfish, rapacious, and unscrupulous of institutions, a shame on the page of history, and yet its principle is founded on the truest thought which can give insistance to our nature. The true principle of social rule is governing the self. This principle to be effective can never be commenced in the mass, for as man is constituted it were impracticable. The principle may and does exist in individual instances and with them it ends. Sociology may be admirable as a science, but a reconstitution of man, alone, can make it practicable. All who read the work must agree with its author and his admirable pleadings, but at the same time must be convinced of the practical impossibility of its application on a large scale. It in fact says that the instinctive perception is to be engulfed in the conceptive intelligence. If this were possible man would exist only in his higher or spiritual nature, and he would be no longer man. Glorious in theory in theory it must end, like the Republic, the Atalantis, and the Utopia; the mythic must succumb to the real.

Since the world was it has been found impossible to repress the harsh dealings of self, without resorting to harsh measures born of the self; and the end usually is, or history lies, a harsher tyranny. The thing still exists as the thing, with a change of form; it is always the self. The conveniency of the self is the first principle; the conveniencies of the other selfs are merely contingent or secondary considerations. Wherever man exists there is always an inequality; it may be of ingenuity or intellect. Self must rule, for as man is constituted, through habit, the self becomes greater than the social equities: the self is personal and individual, the equities are tribal and contingent.

> Spencer says, "Ethically considered, there has never been any warranty for the subjection of the many to the few, excepting that it has furthered the welfare of the many; and at the present time the furtherance of the welfare of the many is the only warranty for the degree of class subordination which continues."

When we consider the true meaning of this sentence, it is self-expediency. "The whole that is possible of sociology is that social government has (must) to undergo a transformation which will make the regulating classes feel, while duly pursuing their interests, that these interests are secondary to the interests of the masses whose labours they direct." Spencer's observation although made in respect of Trades Unions, is true of the whole community. Even in this refinement it is self, and self. It has been so while this world has been, and it will be whilst this world is, so long as man is man. The true rule is to

> Educate the people, and by their own force each class will assume its true position; "remove all the props by which the brass and iron folk are kept at the top, and by a law as sure as gravitation they will gradually sink to the bottom." "Thoughtfulness for others, generosity, modesty and self-respect, are the qualities which make a real lady or gentleman," and "one does not see why the practice of those virtues should be more difficult in one state of life than another" (Huxley). Novalis says: "We see a future philosopher in him who restlessly traces and questions all natural things, pays heed to all, brings together whatever is remarkable, and rejoices when he has become master and possessor of a new phenomenon, of a new power, and a new piece of knowledge."

In viewing Nature there is more to be considered than its external consonance. Its harmonies and accords are evidences of purpose. Can it be truly asserted that its gorgeous phenomena, hill, dale, valley, mountains, plains, rivers, and seas, its infinite variations of animated life, the beauty of form, and exquisite paintings in colour, are the ultimate consummations of the creative idea?[1] Form and colour have their beauty, but when an aptness is found underlying all, they shine in a newer and more radiant light. This terrestrial potence, *were it the all*, but shows the gauds of Nature—symbolic expressions as they exist in perception. There is a higher faculty which dives beneath these accumulated beauties, ever seeking this cause, and beneath this wealth of gems finds intelligent disposition.

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[1] For what purpose, asks Cicero, "was the great fabric of the universe constructed? was it merely for the purpose of perpetuating the growth of trees and herbs which are not endowed with sensation? The supposition is absurd. Or was it for the exclusive use of inferior animals; it is not at all more probable that the Deity would have produced so magnificent a structure for the sake of beings which, although endued with sensation, possess neither speech nor intelligence. For whom, then, was the world produced? doubtless for those beings who are alone endued with reason" (Cicero, *de Nat. Deo.*, 611, c. 53).

Matter presents her discords—flaming chaos, rapacity, cruelty, and extirpation. Such is the display of the material potence, and were that the formulator of Nature there would be no extrication from the contradictions, tumults, and confusions. When matter is confined to her office order reigns, and the seeming confusion is merged in that purposeness which marshals results. The creative idea, as applied to phenomena, is collective and discriminative; there are no isolations and individualisms in an infinite plan. Nature, by the purpose of her institution, becomes perfect in her homogeneity. Thus the death, the horror and dread, the incidents of the material thought, are but the gate of change; we see life in-glides on itself, rolling onward to reproduce itself, until it expands in the glory of thought. The purpose for which Nature was constituted becomes the inbreeding of spirit through series of changes. The stages of the progressive steps are blotted away, and intellectual Man is the exposition of natural facts, the objective crown of the edifice, reared by cause through effects; and we can say with Novalis:

> "The significance of the world is reason; for her sake the world is here, and when it has grown to be the arena of a child-like expanding reason it will one day become the divine image of her activity." "Till then, let man honour Nature as the emblem of his own spirit, the emblem ennobling itself along with him to unlimited degrees;" and "he who in rigid sequence of thought can lay it open is for ever master of Nature, for her purpose is her fact."

RECAPITULATION.

To recapitulate. Did we conceive that all organic movements are of physical origin, it would lead to the inquiry into the nature of these physics, and we should be compelled to confess that, although Mechanics, Chemistry, and Force (in its various phases) are adapted by Nature to suit her varied requirements, that matter is but the vehicle of their expression, modelled and moulded by impulses foreign to it. The assumption then follows that these physics are not inbred by matter, but that matter is inbred by them, their interaction producing form. Further, we inquire, Whence are they? A question unanswerable by science. All it can say is they are known as impulses through their effects. In organized forms we find vital action, animation inbreeding animation, and in this animation we find so infinite an adaptability that a nerve or muscle set in motion interacts on other nerves and muscles, the organism thrilling in synchronous unison; effects inducing effects, and so perfect the mechanical arrangement that each separate part is endued with a motion of its own, and these motions so blended that the whole mechanism acts as a vibrating spring, and in its elastic rebound repairs its own waste. If we suppose this animate motion originated in matter, it follows that all objective substances are endued with vitality, and we must assume that vitality and matter are synonymous terms. Besides material presentments we have imponderable forces, and these imponderables in their blended energy create the diversity we know as phenomena. Beyond matter and force there is sensation. If we suppose sensation to be an outbirth of matter, we must suppose that each *inanimate* particle composing the universe has sensation. Beyond sensation we have instincts, which in such relations would become arranged sensations. Beyond instinct we have mind, a directing and controlling impulse. If we conceive intellect to be derived from matter then every particle of matter is self-intelligent. If force, sensation, instinct, and intellect, be derived from matter—the conclusions drawn are necessary consequences, as the mass cannot have properties which are wanting in the particles of which it is constituted. We must then say Stahl's inert mass and Hume's "brute matter" is its own creator; that it has form, sensation, force, and intellect, by its own institution, and that ~~in~~ matter is a postulate of Deity.

In an alternative view we find a greater probability. When we consider the perfect arrangement and adaptation of part to part, whether viewed in the minutest presentment or in the most wondrous prodigy, we find in matter only the plastic material upon which every force acts, which every sense permeates, and intelligence commands, all being in, yet not of it. Are we to suppose that the particles arranged themselves, and that so perfect was the accident of the arrangement that the accident is endlessly repeated. If we suppose that Intelligence created, that it adapted, and objectively presented its conception as phenomena, we get nearer to a probable possible. We are ignorant of what matter is, the whence of intelligence, and how it interpenetrates and underlies all phenomena. Order is but a form of intelligence. In conceiving all phenomena as material consequences and all things inborn of it, without impulsion, without intelligence, we plunge into difficulty, and march from absurdity to absurdity; but if we consider that all things are the outcome of intelligence, the darkness is less obdurate, the gloom has radiations of light.

It is not because we do not know what intelligence is that we can deny it to be a power; we see and experience its action in each moment of time. It is not because we see around us objective forms that we are to say that the substance of which these forms consist inbreeds its own powers. We know that the substance to perception can be rendered as impalpable as the intelligence and the imponderable forces. We know as art the technics of man, and we know there is no technic adaptation without intelligence. If we contrast the technics of man with the technics of nature, we are bound in reason to admit that the technics of nature are the results of an intelligence with a power sufficing to execute all its purposes; and when everywhere we see arrangement and the interdependence of effect on effect, we are compelled to conclude there was a purpose in the institution of a Universe, and that it is the objective presentment of an intelligent thought. If, then, there be a thought of this magnitude we can but conceive it as a particle of an intelligent immensity concentrated in itself. We may indulge in a no cause hypothesis, and confess our ignorance; we may indulge in an uncaused cause hypothesis, and show our aspirations for wisdom. In our absolute ignorance of the originating cause, other than the manifestation of intelligence, we cannot present a God, however we may think him; but we can conclude this originating intelligence is omniscient, omnipresent, and omnipotent; that it is in but not of that we know and see. We know not *what it is*, we only know *that it is*.

Man alone of all things organic and organized is an individualism through his mentality; hence, because of his individualism, we must conceive him to be an intellectual entity, with a potence to become, to be achieved by culture. When we contemplate "man's place in nature," we must conceive that there was an object to be accomplished by his existence, and that the purpose was worked out by development. He stands at the head of creation, mind and matter. We know the grand and the mean are relative as to sequences, and that each are but agglomerations of particles, in each differentiated until they reach a finality, that the finality of one stage is the commencing step of the next, until the purpose is effected through the adaptation of existing principles. Nature is a consummation of means. All physics are vital, although not sentient facts; hence life arises by the impulsions of law from the spontaneity of the cause. Can we conceive that the purpose of creation is accomplished by man being born but to die? We can conceive the wondrous development of organized forms, as we know them, and that they were instituted that man might be developed. If there be after this life no beyond for man, he exists but as a thought and expires in its utterance, and all we know of that immensity, the Universe, is as of an ingenious and wasted mechanism springing from nothing and ending in nothing.

We assume to know, but what do we know, as a certainty "of the great kosmic might?" Experience shows there is no finality in the finite. Each man in the impressiveness of his impressions must judge in his own conceptions—by faith, or by facts, a God and intelligence, no God or matter, a Creator or a chance. In assumption, Nägeli says, "We know and we shall know." *Do we or shall we ever know all of the finite?* Du Bois Reymond, in a true appreciation, says, "*Ignoramus ignorabimus.*" GOD, THE UNIVERSE, AND MAN, *as a collective fact* (whatever be the postulates of faith), *is "an open secret," only to be resolved in the Unknown.*

The wont of the age in which Hume wrote was to consider him as an atheist and an infidel. His thoughts, although in advance of his time, were founded on a true philosophy, his object being to induce men to think, and thereby to free themselves from the trammels of dogma. Sir William Hamilton says, "The man who gave the whole philosophy of Europe a new impulse and direction, and to whom, mediately or immediately, must be referred every subsequent advance in philosophical ideas, was David Hume." Accepting the principles of Locke and Leibnitz, he showed the insufficiency of their results. To him mediately is due the philosophy of Kant, of Reid, of Royer Collard, Victor Cousin, and Maine de Biran. Thus German, Scotch and French philosophy is indebted to Hume; but for him "Kant would have continued in his dogmatic slumber, Reid would have remained in quiet adhesion to Locke, and the materialism of Condillac would still be reigning over the schools of France."

Searchers for truth must commence, as great poets do, with Nature, thence ascending to humanity, end by idealizing all in Deity,[1] as the rock which by the stroke of the chisel is sculptured into form, takes from art both its form and its soul. Helvetius held that the literature and spirit of the age move in concert. "The time was when in Italy the word *virtus* meant both morality and valour" but, transposed into *virtù*, it means antiquities and knicknacks. So also there was a time when science meant something more than an apotheosis of matter. Thus the genius of an age means exactly the interest its denizens take in it. A vitiated taste, in a morbid sympathy, may mistake scientific imaginings and their consequent hypotheses for sound deductions, and vicious subtleties for sound moralizings; those healthy at the core will not be corrupted by meretricious interpretations, however much they be the fashion of the day, and may be likened to the philosopher, who, when called upon to observe an enormous creature crawling on the surface of the moon, dispelled the illusion by showing it was induced by a blue bottle fly lubricating itself on the surface of the lens.

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[1] Schiller, in the Ideals, says, "When to me lived the tree, when to me sang the silver fall of the fountain; when from the echo of my life the soulless itself took feeling." In the ideals and the life the two existences unite as the crowning result of perfected art; the life yielding the materials through which the ideal accomplished its archetypal form.

In all we think, in all we feel, there is a needed faith in a something not yet in experience, involving an archetype in a something higher than our thought, and yet beyond all analyzation in thought, hidden in shadows unpierced, but which notwithstanding, culminates in the illimitable and the unknown. Faith is the destiny of man, without which neither science nor philosophy could [redacted] be; it is "the twinkling of that sacred particle of fire which does not confine its light and its warmth to the altar on which it glows." No theory the mind can devise can exist without faith; it being that restless, productive, vivifying, indispensable principle which is the support of our reason. What is the belief in the potence of matter, the fortuitous concourse of atoms, the materiality of the mind, and the omnipotence of physical force, but faith in unproved dogmas? It is a perversion of faith when it embitters itself into intolerance. The most intolerant, perhaps, are those who have an intense faith in the wisdom of of their own irreligion.[1] Whatever a man be, whether politician, experimentalist, poet, or cobbler, if he exclusively cultivates that calling, he becomes as narrow-minded and bigoted as the Chinaman who, when mapping the world, represented the Celestial empire with all its Tartar villages in full detail, and, without that limit, characterized the rest of the world as wilds and deserts, peopled by barbarians. "Strike from mankind the principle of faith, and men would have no more history than a flock of sheep" (Bulwer).

The great thing of all is to know on which side we stand, and where. It is impossible to predicate a Deity without a Providence, and it is equally impossible to predicate a Providence without an immortality of spirit. The assumption of pseudo-science is that there is no God, or if there be, that He is undemonstrable,[2]

[1] Addison, with exquisite irony, says, "that the zealots in atheism would be exempt from the simple thought which seems to grow out of the imprudent fervour of religion. But so it is, that irreligion is propagated with as much fierceness and contention, wrath and indignation, as if the safety of mankind depended upon it" (*Spectator*).

[2] Jacobi says, "To demonstrate God's existence would be to point out a ground or causes of His existence, whereby God would be made a dependent being.

unthinkable; hence that it is impossible to predicate a Providence on the face of phenomena; and as matter is *the only existing fact*, there can be no immortality for man as a sentient entity; but if *there be a God*, *a Providence*, and *an immortality of spirit*,[1] then, as "this world is a school for the education, not of a faculty, but of a man," it follows that *the only true culture is that of the mind*, *its culture*, in the immortality of spirit, *being the preparation for an eternity.*

All thirst for an immortality. The scientific name it fame,[2] thus seeking in the evanescent the abiding; thereby the spirit or essence of man, wherein alone the immortal principle can reside, becomes dependent on a fading or failing memory. There are those who, in a truer wisdom, find an immortality in unending progress, and thereby lift their ideal—virtue and wisdom, "further and further from the breath of man, nearer and nearer to the smile of God." The renown of the sage rarely lives in tradition, and but for the power of picturing thoughts in hieroglyphics, would find no world echo. The material, ruling the thought, obliterates the ideal, and ends in the nothingness of its own creation. With wisdom and hope as the ruling impulses, there were on earth peace and good will. Man in his dual condition unites in himself the perceptive and conceptive: the perceptive bears through life, the ancestral taint of the organic descent; the conceptive finds its ideal even in a chaos of worlds. In the materialistic thought is met the heterogeneous and chaotic. In the ideal thought the homogeneous and intelligent. When man forsakes the ideal for the material, what is the gain? He leaves hope behind, yet does not attain to certainty.

> "Between two worlds life hovers like a star—
> 'Twixt night and morn upon the horizon's verge;
> How little do we know that which we are!
> How less what we may be! The eternal surge
> Of time and tide rolls on and bears afar our bubbles" (*Byron*).

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[1] Man in the only sense "in which philosophy can employ the word is supernatural." Sir William Hamilton termed Jacobi "the pious and profound," who says, "With a felicitous boldness, that it is the supernatural in man which reveals to him the God whom nature conceals." "Mere nature does not reveal a Deity to such of her children as cannot conceive the supernatural. She does not reveal Him to the cedar and the rose, to the elephant and to the moth." (Bulwer). There is no art, whatever may be the symbol, whether borrowed from nature, or whether it be a thought objectively presented, which does not give the expression of an idea beyond external nature, in which there is not some creation which is not found in nature, and which does not appeal to sentiments which would still exist in the innermost shrine of man's being, even if eternal nature were annihilated and man were left a spirit in a universe of spirit (vide *Caxtoniana*, p. 114).

[2] Mallock, "Is Life worth living for?" (*XIX Century*, Sept., 1877), quoting George Eliot, remarks, "in these remarkable verses we have the whole gospel of atheistic ethics, as it is now preached to us, presented in an impassioned epitome."

PART II.

ULTIMATE CONCEPTIONS.

CHAP. I.

THE ATOMIC THEORY.—THE DOCTRINE OF PROPORTION.—BERKELEY'S HYPOTHESIS.

THE atom and molecule are necessaries in scientific disquisitions and are asserted to be existing and ponderable, although analysis has never disclosed them. That all substances are particled is undoubted, and that, matter exists as the basis of objective phenomena, but in its *primordial or ultimate* element it has neither *impenetrability nor substantial form.*[1] Berkeley said matter existed only as it existed in the consciousness of the perceiver, and that unless perceived, to the particular perception it had no existence, but, withal, it continually existed in the great consciousness which permeates, pervades and surveys all things, *i.e. in that consciousness which perceived its existence and by whose conception it became what it is*,—positive to sensation, but negative to the conception which can conceive its ultimate. The particle, as an atom, appears to be capable of dissolution, but is not capable of infinite division, and yet it is assumed to have both weight and dimensions. Water containing a resin in solution, reflected on the screen, under an enlarging microscopic power of 250,000,000 (15,000 diameters), has neither speck, film, nor mote, the spectrum is that of distilled water. If matter were the indurate substance some physicists pronounce it to be, the atom by such an experiment, if existing, must have been detected. When Thomson's infinitesimal weights and dimensions are reached the infirmities of the original proposition still exist. *By sensation* alone the objective material is perceived; that which is

[1] Graham was of opinion, that the various elementary substances, now recognised as matter, may possess one and the same ultimate or atomic molecule existing in different conditions of movement. Were this ultimate form at rest its uniformity would be perfect; but it always possesses motion, due to a primordial impulse, and as the differences in the amount of this motion occasion differences of volume, matter only differs in being lighter or denser matter (*Graham's Researches*).

not perceived by sensation, if it exists, exists only in its primate, and then, so far as sensation is concerned, it is non-existing. That a unit exists it is easy to conceive and that in it is the potence of phenomena,[1] hence it would contain vitality, force, and form, and *would* as a fact *be the unit of life*. Research is at fault, and we should be content to say that possibly the ultimate of matter is some amorphous imponderable principle which by an interior action is objectively presented.[2]

Anaxagoras propounded that the ultimate atoms of every substance were the same as the substance itself. The theory of Leucippus of Abdera, was adopted by Democritus and Epicurus, who, it may be said, were the founders of the atomic theory.[3] According to them Matter and Space alone exist, infinite and unbounded, and have existed from all eternity, and enter into the combinations of all forms, but have no common property, the solid particles being matter, the interstices space. Anterior to the projection of the universe, space and matter existed uncombined, ultimate space existing as a perfect void. The ultimate of matter consists of atoms so small that the corpuscules of light, heat and vapour, are compounds of them, and so solid that they can neither be abraded nor broken, and vary in shape, as round, square, pointed, and jagged, each form possessing an intrinsic power of motion. Democritus held that the motion was perpetual and of two kinds, a descending motion and an abounding motion, occasioned by their collision and clash. To these motions Epicurus added a third, by which an oblique or circumlinear motion was engendered. These motions induced the collision of the atoms, which flying in every conceivable direction adhered by their jagged points; the interstices between them becoming filled with other atoms, masses resulted, in figure globular, square, or oval; when closely compacted they produced solids, when lax of texture, water or vapour, and by their agglomerations a world grew into form, which was perpetually sustained by clouds of atoms rushing with inconceivable velocity into the interstices left unfilled through others flying off. They held that the only eternity and immutability were the elementary atoms, that the compound forms of matter were always decomposing and resolving into their original corpuscules, and in this manner the world will perish. It had a beginning and will have an end, and when resolved into its original atoms, a new world will arise from its ruins. This theory, with various modifications, kept possession of the philosophical thought of Greece, and *is insisted on by some* in the present time.[1]

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[1] Lehrbuch says, "if atoms can neither be measured nor weighed it is plain in the hypothetical assumption of determinate atomic weights we have nothing to guide us but speculative reflection." Pouchet says, "the atomic system of Leucippus and Epicurus, defended by Descartes and Gassendi, is overthrown. Leibnitz defined an atom "to be a simple substance which had neither figure nor extent, nor capacity of division." Clark Maxwell observes, "that which has neither figure nor extent can have no existence." Thomson (Wm.) says, "the assumption of atoms can explain no property of a body which had not been previously attributed to the atoms themselves." "If an atom admits change of form and altered relations where is its unity? It cannot slide upon itself, and if it would admit of partition it would not be an atom." Balfour Stewart says, "a simple elementary atom is probably a state of ceaseless activity and change of form, but nevertheless always the same."

[2] By a delicate test it is shown that the iron core of the electro-magnet was increased in length by magnetization. When the magnetizing force was removed, the iron returned to its former dimensions (A. and T. Gray, *Nat.*, vol. xviii, p. 329). This appears to prove that the magnetic force resides in the particles of the iron,—latent—active only when excited.

[3] The poem of Lucretius embodies the atomic theory. Dugald Stewart speaking of the poem of Lucretius, says, "Its sublimity will be found to depend chiefly on those passages where he denies the intemperance of the gods in the government of the world: in the lively images which he indirectly presents to his readers of the attributes against which he reasons. . . . . The sublimest descriptions of Almighty power forming a part of his argument against Omnipotence." (*On Sublimity*, Essay 2). Bulwer asks, "Could any one reading the poem conceive that these harmonious lines could be strung together by a fortuitous concurrence? and follows it not as a corollary of common sense that if a poem cannot be written without a poet, the universe cannot be created without a Creator? (*Caxtoniana*, p. 19).

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[1] The poem of Lucretius is the basis of the material dream "the potence of matter." He concluded that atoms are indivisible bodies, and must be perfectly solid. He impugned the idea of Heraclitus that all things were formed from fire, and of others, that they were formed of air, earth, or water, or were of a binary combination; and that also of Empedocles, who taught all natural substances were produced from the joint union of fire, earth, air, and water. He (Lucretius) supposed, that the atoms of matter, by variations in combination, produced all the objects of nature, animate and inanimate, and illustrates his idea by showing that the endless array of words, meanings, and sounds, are but combinations of letters. He believed in the eternity of matter, denying its creation or destructibility and asks, if everything which disappears through age or decay is actually annihilated, whence is the renewal of animal or vegetable life? and how do rivers continue to flow?" "Nothing really perishes, nature producing new forms of matter from the materials of those which apparently have been destroyed." Some philosophers of Lucretius's time were of opinion, to which he was opposed, that there exists a universal law of gravitation, by which all bodies tend towards the centre of the earth as the centre of the universe, and that in consequence, the bodies of those animals which inhabit the *opposite*, or as it were, the inferior surface of the earth, are no more capable of falling into the sky which surrounds them than the animals inhabiting our side are capable of rising into the sky above them; they also held that when it is day on the opposite side it is night with us (lib. i, 1051-1065). He seems to have had no idea of the character of positive gravity, yet of specific gravity he gives a true explanation, "that the heaviest bodies have most matter and have fewer pores." He says, these pores exist not only in wool and similar bodies, but in those hard and compact, and instances the percolation of water through the roofs of caverns, and the transmission of food both in animals and plants to their extreme limbs and branches. Light he conceived to be a subtle matter which from its tenuity is capable of an inconceivably swift motion. That colour cannot exist without light, and is not inherent in bodies but produced by the direction in which the light impinges on them or on the eye of the perceiver, and argues colour does not belong to the constituent parts of bodies, for when they are reduced to minute particles the colour

The atomic theory is sometimes called the doctrine of chemical proportion. The earliest illustrations appear to be those of Wenzell (1777), who showed when two neutral salts decomposed each other the resulting compound was neutral. Dr. Bryan Higgins (1786) held elastic fluids unite with each other in definite proportion only. W. Higgins, relative and pupil of the Dr., propounded the same views, and mentions various compounds of azote, azote and oxygen as combining in varying numbers of atoms. His idea of the atomic composition of water is that of science. Neither of the Higginses, Davy says, attempted to express in numbers the quantities in which the atoms combine. Richter endeavoured to determine the capacity or saturation of each acid and its base, and to indicate by number the weight of the mutual saturations. Proust attempted an accurate analysis of metallic oxides. He found metals unite with determinate proportions of oxygen, and with sulphur, and that the proportions might be designated by figures. Dalton, of Manchester (1803), laid down clearly and numerically the doctrine of multiples, and endeavoured to express by simple numbers the weights of all bodies then known as elementary.[1] His general rule was that when

vanishes (lib. ii, 825-832), and employs terms which correctly express the angles of incidence and of reflexion, and describes the effect of refraction in altering the line of direction of the rays of light (lib. i, 1051-1066).

He supposed heat to be a material substance, because it excites a specific sensation in animal bodies, and that the heat rays and light rays emitted from the sun are distinct (lib. i, 299, 304, lib. v, 609-612), The sources of heat were produced by rapid motion and friction, aud observing that a spring of water was periodically warmer in the night and colder in the day, he supposed the heat to be forced out by the compression occasioned by a diminution of temperature from the surrounding earth into the water. *(Had he said it was due to the relative temperature of the surrounding air, he would have given the explanation of modern science.)* He knew water could exist as an invisible vapour, and that constant exhalations arose from the sea, and that in consequence of these exhalations the sea does not increase in quantity by the constant influx of rivers and rain, a balance being thus preserved (lib. v, 381-394). Air he held to be a tangible and material substance, because of its violence in storms (i, 272), and because it offers resistance to falling bodies (ii, 230) and is a receptacle or medium for conveying sounds and odours (iv, 561-219). He notices the attraction of iron by the magnet, and supposed that from the magnet, as from all other bodies, minute and specific particles are continually emanating, and these emanations dissipated the air from the space intermediate between the magnet and the iron. As an illustration he instances the experiment of a chain of iron rings, and as a reason says, "a partial vacuum being thus formed the ring is impelled by the air on the other side of it, and adheres by an invisible bond of union, and so in succession all the other rings are impelled, the adhesion being similar to that of glue to wood, mortar to stone, and dye to wool" (1706-1088). He had no belief in the gods, and writes of believers:

"They saw the skies in constant order run,
The varied seasons and the circling sun,
Apparent rule, with unapparent cause,
And thus they sought in gods the source of laws."—v. 1182.

[1] Simple elements, or elementary bodies are those substances which science has failed to decompose.

only one combination of two bodies can be obtained, it must be presumed to be a binary one, unless a cause to the contrary is shown. Atoms of oxygen and hydrogen were suggested by him as units because both are found in water.

According to the theory all composite forms consist of atoms in distinctly definite proportions. This generally is true, but to completely prove an hypothesis it should agree in each minute particular. This, the new system of chemistry, by almost infinitesimal divisions attempts to do, by making a molecule consist of one, two, or more, or even a hundred particles termed atoms. However great the merit of Dalton's theory, it was not until Wollaston published his memoirs on acids and the synoptic scale of chemical equivalents that the theory was adopted (1814). Berzelius (1808), in consequence of Richter's work, entered upon the investigation. Guy Lussac discovered important laws relative to gaseous bodies, as did also Avogadro, Charles, Marriotte and others. Prout (1815) observed the atomic weights of bodies to be the atomic weights of hydrogen by a whole number. Thomson adopted Prout's views, and added, if we except a few compounds into which a single or odd atom of hydrogen enters, the weights are all multiples of 0·25 or of two atoms of hydrogen. The experiments of Berzelius, confirmed as they had been by the researches of Turner, threw doubts on the general propositions of Prout. Faraday proved by experiment that for a definite quantity of electricity an equally definite or constant quantity of water or other matter is decomposed, and that the electricity evolved by the decomposition of certain quantities of matter are alike. According to him the equivalent weights of bodies are simply those qualities of them which contain certain quantities of electricity, or adopting the atomic phraseology, *the atoms of bodies which are equivalents to each other in their ordinary chemical character have equal quantities of electricity associated with them.* Physicists are not agreed on the atomic theory or its nomenclature. Dalton, Thomson, Henry, and Berzelius, adopted the atom, Wollaston and Turner equivalents, Humphrey Davy, Faraday, and Brande proportion or proportional.

There are substances which, although composed of "the same elements and have the same chemical formula, the same vapour density, and specific gravity," yet present essentially different characteristics, termed *isomeric* bodies. They usually consist of few chemical elements. Carbon is usually, it may be said, always present, the other components being nitrogen, or oxygen, or hydrogen ; some one or more of them are in ultimate and intricate mixture with carbon, the number of atoms united in a single molecule of the substance sometimes exceeding 100 (Cooke).

"Leaving out of view the large mass of water which organized matter contains they consist almost exclusively of carbonaceous compounds." A great characteristic of carbon, on which the complexity and variety of its compounds depend, is the power its particles display of combining among themselves to an extent which may be considered as almost infinite (ib). The discovery of the existence of these isomeric compounds is due to the inferences drawn by an anonymous writer from some experiments Henry made on the compounds of carbon and hydrogen.

"To simplify is the true essence of philosophical explanation. Matter pursued into its last haunts no longer presents itself as one undivided stuff which can be treated as a continuous substratum, absorbent of all number and distinction, but as an infinite of discrete atoms, each of which might be although the rest were gone," implying that they are separable and comparable members of a genus. "The atomic doctrine, when pushed into a theory of organization extravagantly vitiates the first conditions of philosophical hypothesis" (*Correlation of Forces*).[1]

The doctrine of definite proportion which led to the modern atomic theory presents difficulties when extended to all chemical combinations. In substances whose mutual chemical attraction are very feeble the relation fades away, and is sought to be recovered by applying separate and arbitrary multiples to different constituents." "Thus, 27 parts by weight of iron would combine with 12 parts by weight of oxygen, and also 27 parts of iron will combine with $10\frac{2}{3}$ of oxygen. If we retain the unit of iron we must subdivide the unit of oxygen, and if we retain the unit of oxygen we must subdivide the unit of iron, or subdivide both by a new divisor." "What, then, becomes of the notion of the atom, or molecule, physically divided?" "Numerous other substances fall under a similar category." "Taking albumen, composed of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulphur, the difficulty is much greater; the case may be extreme, but such cases test the hypothesis" (*ib.*)

The compounds of carbon hydrogen, &c., are the ingredients of the protoplasm. Cooke says, the chemist can collect them, manipulate, re-form, and trans-form them, but "has never succeeded in forming a single organic cell, and the whole process of its growth and development is entirely beyond the range of his knowledge" (*New Chem.*). Still the wild dream is indulged in; for continuing he observes, he has "every reason to expect that in no distant future the chemist will be able to prepare in his laboratory both the material of which the cell is fashioned and the various products with which it becomes filled during life" (*ib.*)

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[1] Grove says, "chemical affinity, or the force by which dissimilar bodies tend to unite and form compounds is a word ill chosen." Further, "that chemical action may be regarded (vaguely, perhaps) as molecular attraction, or motion. Speaking of the explosion of gunpowder, he says, "It may be a question whether it is not rather a liberation of other forces existing in a static state of equilibrium, having been brought into such a state by previous chemical action, but at all events through the medium of electricity chemical affinity may be directly and quantitatively diverted into other modes of force" (*Correlation of Forces*).

> "There must be something in the construction of matter, or in the forces which act on it, to account for the *per saltum* manner in which chemical combinations take place, but the idea of atoms does not seem to account for it." "I cannot accept as an argument in favour of the atomic theory those combinations made to support it by an arbitrary notation." The conclusion of the paper on *Chemical Affinity* is as follows:—The licence taken "in theoretical groupings deduced from this doctrine may produce confusion rather than simplicity, and are to the student an embarrassment rather than an assistance." (Grove.)

Cooke, speaking of the new chemical formula, says:

> Our deductions are the expressions of theoretical conceptions, which we "cannot for a moment believe were realized in nature in the concrete forms our diagrams embody." "Theories are the only lights with which we can penetrate the obscurity of the unknown, and they are to be valued just so far as they illuminate our path. This ability to lead investigation is the only true test of any theory." The modern theory of molecular chemistry is the outgrowth of new discoveries. Although "the cause which determines the growth of organized beings is still a perfect mystery, we now know the materials of which they consist are subject to the same laws as mineral matter, and the complexity may be traced to the peculiar qualities of carbon."

Molecules are still in the region of hypothesis. Though they and atoms are busily introduced into every scientific treatise, little is known of what they really are. Clerk Maxwell says, "a molecule in hydrogen gas is identical with an atom" (how widely the "new chemists" differ in their idea of a molecule is illustrated in every step of their theory), although indestructible, it is not a hard rigid body capable of internal movement, and "when excited emits rays the wave-lengths of which are the measure of the time of the vibration of the molecule." The objection to all molecular theories hitherto propounded is that none have presented a mathematical solution. The *first* may be stated to be attraction and repulsion. When the former preponderates the body is a solid; when both are equal, *i.e.* in equilibrium, it is a fluid; when the latter is in excess, gas results. This is Boscovitch's theory, the force foci presented in the guise of molecules. To the idea embodied by Boscovitch Faraday inclined. The *second* is that the atoms of matter are mutually attracted by a law analogous to gravitation, but surrounded by an atmosphere repulsive one of the other, in the same manner as are the particles of elastic fluids (in other words, polarization). From this theory it is said some mathematical deductions may be drawn in the shape of equations of equilibrium and of progressive and rotary motion, but from whence, by this theory is to result liquefaction and crystallization, is not shown. "Navier and Poisson, in their theories, show what latitudes may be indulged in." The *third* theory is the supposition of forces sufficiently powerful to prevent the impenetration of solids by solids, but which are yet sufficiently strong to prevent their cohesion being destroyed without the application of great force, and yet are insensible to bodies at a minute distance from them. This theory also presents data for mathematical analysis of some sort, but the difficulty is relative to the definite integrals. These theories jointly point to force foci and polarization. All we arrive at in the shape of a definition is the old theory of Democritus and Epicurus, *that indivisible particles in their agglomerations builded the Universe.* The conclusion of the theories of these philosophers is the peroration adopted by Clerk Maxwell, at Bradford, which excited such an *ethical* glow in the mind of a popular lecturer. There is no severance in principle, matter is created or uncreated; if uncreated, it exists by its own energy, and all things and thoughts are of it, and is *the Primal, Uncreated cause.* Matter is defined to be an inert mass composed of parts and moved by forces. Where in all this are we to find the motor fact? What becomes of the philosophical axiom that "likes produce likes?" A dilemma is presented only to be solved by Hume's doctrine of probabilities.

To say there is no such thing as matter, originating from the supposed teaching of Berkeley excites a general sneer. Did he so teach? Where, in his theory, is such teaching to be found? His whole hypothesis is based on the notion of phenomenal objects existing in the mind—ideas. The theory is that matter has no existence, except as it is perceived by each particular mind; but he maintains it always exists in the conscious mind of God. Hume asserts Berkeley's arguments (though otherwise intended) are in reality merely sceptical, for they admit of no answer, and produce no conviction" (*Essays*, vol. ii, p. 224). Fraser (Berkeley's editor) says, "The present existence of something implies the internal existence of mind. If something must exist eternally, being as such involves mind. Berkeley's *Natural Theology* is grounded on the very existence of sensible things, apart from all marks of design." "His whole argument respecting God is an *à priori* assumption." His theory of vision is accepted by science, but was denied by Petersfield, who contended the distance of visual objects depends not on custom and experience, but on original connate and immutable law, to which mind has been subjected from the time it first entered into our bodies. The power to judge distances is an educated quality. Helmholtz holds this theory, but Tyndall holds an opposite view, based on facts supplied by Lady Annerly in her observations on newly hatched chickens.[1] Condillac suggests we gradually learn to hear, see, smell, taste, and touch. Erasmus Darwin was of the same opinion. The senses may be perfected by a reasoned comparison, but the potence appears to be innate. Malbranche's proposition, that a man blind from birth ceasing to be blind could not distinguish between a cube and a sphere, shows only that particular conditions, *i. e.* ideas of things, are acquired by experience, and that the senses are the avenues by which experiences are realized.

Berkeley's theories:

Light, heat, colour, figures, cold, extension, are so many notions, sensations, ideas, or expressions on the senses, and cannot be divided even in thought. When the scent of a rose is suggested the rose is suggested, because it is impossible to conceive in thought any object distinct from the perception of it. If they be not perceived, or do not exist in my mind, or in that of another created spirit, they have no existence, or they subsist in the mind of some eternal spirit. *Matter* is only the unknown support of unknown qualities. Qualities are only sensations or ideas, and exist only in the mind perceiving them.

The terms of language convey ideas often contrary to the true philosophy of the thing. We say the sun rises and sets; these appearances are but the effects of the world turning on its axis. There is in language an exoteric and an esoteric mind. Before we argue on the philosophy of effect it is quite necessary the meaning of language should be understood. Thus, fire burns is an exoteric thought; esoteric, as the vibration of particles, but whether the exoteric or the esoteric meaning is resorted to it is only an effect. "Difficulties are occasioned by supposing a twofold existence in the objects of sense—one intelligible or in the mind, the other real and without the mind." The doubtfulness which bewilders and makes philosophy ridiculous vanishes if precise meanings are annexed to words, for unless there be a fixed meaning it is in vain to dispute about the existence of a thing.

Thing, or being. The most general name of all comprehends two kinds entirely distinct and heterogeneous, having nothing common but the name, as spirits, ideas, the former active, and indivisible, the latter inert and fleeting. We comprehend our own being by inward feeling, that of others by reason.

The difference between natural philosophers and other men in regard to natural phenomena consists not in an exact knowledge, but in greater largeness of comprehension, whereby analogies, harmonies, and agreements are discovered in the works of nature; the effects are explained and reduced to general use.

Material views were first induced by men supposing that colour, figure, motion, and the sensible qualities or accidents existed without the desire of the mind. It seemed needful to suppose some substance in which it did exist, as they could not be supposed to be self-existing; but when it was shown these qualities did not exist without the mind the substance was stripped of its efficacy. The concurrent consent of mankind is adduced as an argument for the existence of matter, as if it were the immediate cause of their sensations; but this is only a proof how men impose on themselves, and arises from their perceiving ideas of which they knew they were not the authors, and led to the supposition that the objects of perception existed without the action of the mind. The knowledge of nature is the sequence of a succession of ideas, by which predications are made concerning ideas, which ideas are the perceptions of things, the things themselves being but embodied thoughts existing in consciousness. The finite comprehends the finite; the spirit finite perceives infinitude. The perception of ideas does not imply the relations of cause and effect, but is only a sign of the thing signified; and matter is only an inert substance, by the presence of which ideas are excited in us, and is the increment of simple ideas. The divine will is the cause of the phenomena being constituted, combined, or substantiated. The mind is a necessity, because the object requires a percipient, and exists only as perceived and conceived by intelligence, sense perception being all real, and conception its imaginary existence. Mind thus has the place of locality and space. "The very existence of an unthinking being consists in its being perceived."

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[1] Lady Annerly observed chickens hatched by a hen. I have reared many hundred chickens. As a general rule the hen teaches them to peck. It is the exception *to find the chick pecks without instruction.* Of what chickens hatched in an incubator would do, I have no experience (*vide* note 1, p. 97). Galen's goat appears to supply the needed evidence.

Motion can only be relative. There must be two bodies, the positions of which are varied, yet one only may be moving. We conceive space in the exclusion of all bodies. Things must be the passive objects of a conscious mind, or be controlled by minds; or, if active objects, then by minds conscious of and capable of regulating them.

Matter is an inert, senseless substance, in which extension, figure, and motion subsist, but these qualities are only ideas existing in the mind. An idea can only be like another idea. It is possible substance can exist without the mind, but it must be known by sense and reason. By sense we know those things perceived by it, but it does not inform us that things exist without the mind. Because extension and form exist in the mind it does not follow that the mind is extended and figured, for they are qualities only proved in it in the way of idea. Thus words express things, not qualities incidental to them; and how matter can operate on a spirit, or produce an idea in it, is what no philosophy explains. The connection of ideas does not explain cause and effect, but is only a sign of the thing signified.

The whole visible universe consists of types, or signs, reflex. Man is a sort of organ played on by outward objects, "and as is the difference of textures and nerves, so are the motions and effects produced."

Of *free agency*. The difficulty in such discussions is confounding things evidently distinct, as body and spirit, motion and volition, certainty with necessity, and in the supposition that man is not a free agent; then pleading for freedom of thought and action. The only true notions we have of free agency or action is by reflecting on ourselves and the operations of our own minds. To unteach men their prejudices is a difficult task, but it has to be done before they can be taught truth.

Time being nothing when abstracted from the succession of ideas in our own minds, it follows that the duration of a finite spirit must be estimated by the number of ideas, or actions succeeding each other in the spirit or mind. It is the same with extension, motion, and other qualities; consider them by themselves and they are lost.

The power to recall ideas is but to will, and the idea arises in the imagination; but the ideas perceived by sense have not the same dependence upon will. The ideas of sense are more distinct than those of the imagination, and have more steadiness, order, and coherence. The sensations are the laws of nature, which we learn by experience. The teaching is that certain ideas are attended by other ideas, which enable us to regulate our actions for the benefit of life, without which we should not know how to procure pleasure, or to avoid pain. It is by the discovery of the connection of ideas we are enabled to act.

Every phenomenal change requires a cause, which cause cannot be itself phenomenal. Visible ideas are the language which informs us of tangible ideas when we excite certain motions in our bodies. "Sensible things are all immediately perceivable, and those things immediately perceivable are ideas which exist only in the mind." "The brain, being only a sensitive thing, exists in the mind." "Things are imagined as truly in the mind as things which are perceived" by the senses. "All that we know or perceive are our own ideas." If "all ideas are occasioned by an impression on the brain," it is an "idea imprinted on an idea, causing the same idea." This would be unintelligible. "The reality of sensible things exists in an absolute existence distinct from them; being perceived, it follows sensible things must exist in the mind. The conclusion must be, not that they have no real existence, but as they depend on my thought and have an existence distinct from being perceived, there must be some mind wherein they exist." The mind does not create the thing, it perceives it, but to that mind it is an existence only whilst it is perceived or exists in idea; but to be an existence it must exist in some mind by which it is always perceived. Philosophy attributes to sensible things "an absolute existence distinct from their being perceived by any mind whatever." "Is there no distinction between saying there is a God, and therefore he perceives all things, and in saying sensible things do really exist, and if they really exist they are necessarily perceived by an Infinite mind; therefore there is an Infinite or God?" The distinction between the mind of man and that of God, the Finite and the Infinite, is that the Infinite always sees, the Finite only partially and at intervals. *Man cannot conceive even in thought all he holds to be true in fact.*

"By matter I suppose something which may be discovered by the reason and not by the senses." We have a congerie of sense ideas, or phenomena, presented to the different senses; we perceive some qualities and infer others which these suggest.

That which Berkeley refers to as the supreme mind, Mill terms the permanent possibility of sensations; Hume and Comte accept their orderly appearance, but prefer to be ignorant of the cause of that order.[1]

There are two states—the entypal or natural, the archetypal and eternal—existing from everlasting in consciousness. Berkeley supposed himself to be subjected to influx from the Infinite mind.

In the above digest the bishop has spoken for himself. It presents some prominent points of his theory. The words generally are his, the ideas always.

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[1] Byron, in relation to Berkeley's idea, *Opening Canto XI*, Don Juan, says:—

When Bishop Berkeley said, "There was no matter,"
And proved it—"'twas no matter what he said."

Brewster remarks, "The celebrated and ingenious Bishop of Cloyne, *Principles of Human Knowledge*, denies, without any ceremony, the existence of any matter whatever." "This deduction, however singular, was readily made from the theory of our perceptions laid down by Descartes and Locke, and at that time generally received in the world. According to that theory, we perceive nothing but ideas which are present in the mind and which have no dependence whatever upon external things; so that we have no evidence whatever of the existence of anything external to our minds."

CHAP. II.

MATTER.—THE BELFAST ADDRESS.—THE BIRMINGHAM ORATION.—HEAT, A PRINCIPLE CONDITIONED.

VITALITY is *the integer* of life, an ultimate fact, and through the spontaneity of its action we have phenomena, moulded matter; but in the materialistic philosophy Matter, undesigned, becomes the parent "of all forms and qualities of life." [1]

From time to time attempts have been made by Theologians, by addresses and treatises, to arrest the materialistic tendency of thought inculcated by the teachings of the science lecture-room. However eloquent the denunciations they have failed to effect the purpose intended, because the questions have not been unbiassedly argued, or because the arguments have been founded on a *given*. Authoritative dogma is effective when addressed to faith, but doubt can be suppressed alone by reasonings from an inevitable induction on or from proved antecedents. The materialist starts with matter as his *given;* the theologian with a triune God and his attributes.

The science professors (with rare exceptions) have been silent, or have covertly promulgated views according with those of "the Belfast address" and "the Birmingham oration." In Germany, when Haeckel's *no God* hypothesis was presented it was received with a shudder (*Times'* reporter). At Belfast, in an assembly of the representatives of the science of England "the address" was listened to, and its tenets accepted without protest. Whilst at Birmingham other ultra views, ingeniously and speciously presented, were greeted with applause by the scientific worthies of the Midland counties. The snare of words, with artistic marshallings and graces of elocution, are calculated to subvert the judgment for the moment, by giving an unreal gloss to hypotheses and the inductions derived from them. Examination may prove their fallacy, but in many cases the words do their intended work, as all men have not that character of doubt which excites reflection. Tyndall, although extreme in his assumptions as to material consequents, sometimes doubts the soundness of his premiss. He says: "What baffles and bewilders me is that from the motions of these physical tremors (*molecular hypothesis*) things so utterly incongruous with them, as sensation, thought, and emotion, can be derived."[1] Matter being motionless unless moved by forces, "physical tremors" are movements from without, inborn of vital energies. All science proves that the motions of matter arise through impulsions from without. This should suffice to disprove that matter, in any way, originates; matter assumes a more moderate rôle than that of creating. Pursuing the subject, we have the professor saying, "As far as the eye of science has hitherto ranged through nature, no intrusion of a purely creative power into any series of phenomena has ever been observed." If an intricate mechanism or a common jug be presented for inspection, in them, no more than in nature, do we see the fact "of a purely creative power." We see the things in their perfected forms; in the same way we see in nature perfected forms. In the mechanism and the jug *we know an intelligent designer* has been at work. Where is the distinction in principle between man's work and that of the intelligence to which nature's work is due? If materialism can only be supported by absurd sophisms, where are we to find a stable foundation for it? If the utterances quoted be *science*, well may it be said that science is but "scientific (?) imagination." No thinker would dissent from the proposition "that it has been the vocation and triumph of science to disclose the method of nature;" the objection is to those who, viewing the worked up materials, see in the material the causal fact. Even a materialist can be sentimental—emotional were perhaps the proper phrase. "Profoundly interesting, and indeed pathetic, are those attempts of the opening mind of man to appease its hunger for a cause." The *emotional* sneer may be answered by pitying the man who can urge that an effect has no antecedent cause.

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[1] Serious misconceptions, Jevons (*Principles of Science*) says, are entertained by some scientific men as to the logical value of our knowledge. He expresses a strong conviction that "the reign of law will prove to be an unverified hypothesis, the uniformity of nature an ambiguous expression, the certainty of our scientific inferences to a great extent a delusion. Science is of value while the conclusions are kept within the limits of the data on which they are founded. Our experience is of the most limited character, while our mental powers seem to fall infinitely short of the task of comprehending and explaining fully the nature of any object. I draw the conclusion that we must interpret the results of scientific method in the affirmative sense only. Ours must be a truly positive philosophy, not that false negative philosophy which, building on a few material facts, presumes to attest that it has compassed the bounds of existence, while it nevertheless ignores the most unquestionable phenomena of the human mind and feelings" (Dean of Manchester, 1876).

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[1] "The faculties of the mind are outside the field of science, for we get our knowledge of them, not through the senses but by the retrospection of consciousness" (Porter, *Science and Revelation*). Spencer says, "that of the substance of the mind nothing *is* or *can* be known by science."

A paper is offered as an apology for the Belfast address (*Frag. Sci.*, p. 538, 2nd Series). The title is a misnomer, and proves to be the defence of a thinly disguised atheism.

If Tyndall does not fear the charge of materialism, why does he so continuously struggle against it? If he believes matter to be what he asserts it to be, why does he not rest his vindication on his propositions? Darwin (about the best-abused man of the time) affords an example; unruffled by "winds of doctrine," or the stormings of his assailants, he rests on the conviction that he has done his best to present in an intelligent form creation's facts. When the boundary of "experimental evidence" is passed, that of imagination and sensationalism is usually entered upon. Nature is the measure of our perceptions. New problems are presented; we look for the interpreter, he comes; we have only the same old wares, newly polished. We turn to Nature, she is a true witness, she cannot lie, and will not be debauched. Endless and boundless in her resources, the oneness everywhere found—infinite diversity, the synchronous life of the mass serving innumerable ends, without preference, but with a forever existing emphasis. In her growths, decays, and recuperations, to the true seeker there is no room for imagination. Nothing appears to be final, all a rapid metamorphosis, the consummation of a purpose,—the termination of phenomena in man.

The literature of an age stamps the character of the age, and the lesson to be learned is that history, like all things dependent and finite, repeats herself. To instruct, a teacher should occupy the whole space between himself and his hearers, and draw from facts supported by evidences that induction which should penetrate the sense of the crowd,[1] in his strength aiding and helping, or the aim of his philosophy will become vague and indefinite. Bacon, as an aphorism, has—"Words are the counters of wise men, but the money of fools."

Whether matter be the creator of nature, with mechanics and chemistry as its moulders and workers, or whether they be but the tools of nature, and matter the vehicle by which phenomena is disclosed, is the scientific contention of the time. If matter be that which Tyndall affirms it to be, in it we behold the creative principle, and the interval of time between now and that of Lucretius is swept away. If this position be but assumption and anarchism, matter then becomes the objective form of a subjective idea.

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[1] "I have a strong impression that the better a discourse is as an oration the worse it is as a lecture. The flow of the discourse carries you on without proper attention to its sense; you drop a word, or a phrase, you lose the exact meaning for a moment, and while you strive to recover yourself the speaker has passed on to something else." "Our way of looking at nature varies." The great business of a scientific teacher is to imprint the fundamental facts of science. "Every term used, or law enunciated, should afterwards call up vivid images" of that "which furnished the demonstration of the law, or the illustration of the term," "the teacher endeavouring not so much to show a thing to a learner as to make him see it himself" (Helmholtz).

The address delivered at Belfast (1874) may be said to be the initiation of the scientific materialism of the day. The utterances of convictions, though not in consonance with those of other men,who shall condemn ? A man should stand or fall by his own avowal, but when others are used as cloaks for the opinions of an author, when works are misquoted, or misconstrued, suggesting views which their authors neither professed nor possessed; though the argument presented be powerfully handled, however subtly the conclusion may be presented, doubt is awakened, and *that* doubt induces examination, and when the subject is divorced from subtleties and imageries the fact appears, either deformed and distorted, or shining in the simplicity of its truth, and by its own energy enforces conviction. An acquaintance with the works of Giordano Bruno and Gassendi would never brand them as materialists; nor from their works could it be conceived that either Goëthe or Carlyle "rejected the conception of the relation of nature to its author."[1] A comment rather than a criticism on parts of the address is here attempted.

The contemplation of nature discloses that every physical fact displays energy and contrivance, hence an intelligence linked with a power sufficing to consummate all phenomena. When Huxley asserts that "*mind is the only certainty*," and Tyndall discerns in matter "*the promise and potency of every form and quality of life* (*Times* rep.), we have a conflict of opinion. John of Erigena, with whom Bruno concurred, said all things were created by intelligence, and to intelligence all things will return (*vide* Draper, *Con. of Sci.*). Materialists do not distinguish that mind and matter are distinct in principle; that a vase and its contents are not the same; that the vase can have one origination, its contents another, and yet be presented as a single object; hence arises the indiscriminating rubbish almost invariably found in materialistic treatises.

When the material idea is reduced to a syllogism, we see the outcome.

Matter, an inert mass, is affirmed by materialists to be indestructible and eternal.

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[1] The copy of the Belfast address quoted is that of the 7th thousand (Longmans, 1874); the references to pages are bracketed thus (0).

From matter proceeds all "forms and qualities of life."

Ergo, "brute matter" (Hume)—pronounced by physicists to be inert—is the creative principle.

Notwithstanding this induction, we are compelled to conclude that the technics of nature are something more than material accidents. It may be said this is a *reductio ad absurdam; precisely so;* but not the less it remains the logic of the premiss. We see surrounding us everywhere the technics of man in contrast with the technics of nature, and although as far removed as the finite from the infinite, both are the technics of intelligence, as containing purpose and design.

Varied are the opinions pronounced on the address. The unthinking hail it as a searching analysis of science. I have heard it stigmatized as "the froth on the tub," and as "an ill-digested sensationalism." If science be, as Huxley says, "*trained common sense*," many of the conclusions are illogical and unsound. To my mind it is what a law-pleader would term a negative pregnant; negative indeed, for it is pregnant with nothing, an idle and at the same time a mischievous dream, founded on crude hypotheses and ending in illusions.

The atomic theory is dwelt upon. Lucretius is made to say, "Nature pursues her course in accordance with everlasting laws, the gods never interfering."[1] Giordano Bruno is thus cited:

> "Struck with the problem of the generation and maintenance of organisms, and duly pondering it, he came to the conclusion that nature in her productions does not imitate the technics of man; her process is one of unravelling and unfolding. The infinity of forms under which matter appears were not imposed upon it by an external artificer; by its own intrinsic force and virtue it brings these forms forth. Matter is not the mere naked *empty capacity* which philosophers have pictured her to be, but the universal mother who brings forth all things as the fruit of her own womb" (10).

After a diligent search I fail to find that Giordano Bruno (1600 A.D.) entertained the views imputed in the text. By Draper (*The Conflict between Science and Religion*) Bruno is cited in a directly opposite view.[2]

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[1] "Finally, we are all sprung from celestial seed; the father of all is the same ether from which, when the beautiful Earth has received the liquid drops of moisture, she being impregnated, produces the rich crops and joyous groves and the races of man; produces all the tribes of beasts, since she supplies them with food by means of which they all support their bodies; on which account she has justly obtained the name of mother. That which first also arose from the earth, and that which was sent down from the regions of the sky, the regions again receive when carried back."—Lucretius (book ii, 998–1000) (*vide* note 3, p. 159).

[2] In his *Evening Conversations*, he says, "We must believe that the universe is infinite, and that it is filled with self-luminous and opaque bodies, many of

In Tennemann's *History of Philosophy*, by Morel, there is a notice of Bruno confirming Draper.[1] Uberweg (*History of Philosophy*) has also a notice.[1]

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them inhabited; that there is nothing above and around us but space and the stars. His meditations on these subjects had brought him to the conclusion that the views of Averroes were not far from truth, that there is an intellect which animates the universe, and of this intellect the visible world is only an emanation or manifestation originated and sustained by force derived from it, and were that force withdrawn all things would disappear; this ever-present and all-pervading intellect is God, who lives in all things, even such as seem not to live; that everything is ready to become organized to burst into life. God is therefore the one sole cause of all things, *the all in all* (*Conf. Sci. and Rel.*, p. 179).

[1] "God, the first principle, is that which all things are, or may be. He is one, but in Him all essences are comprehended. He is the substance also of all things, at the same time their cause (Final, Formal, Creative). Eternal without limit of duration (*natura naturans*). As the first efficient cause, He is also the Divine and Universal reason which has manifested itself in the form and fashion of the Universe. He is the soul of the Universe which permeates all things, and bestows upon them their forms and attributes. The end contemplated by this great cause is the perfection of all things, which consists in the real development of the various modifications of which the different parts of matter are susceptible. To be, to will, to have the power, and to produce, are identical with the great universal principle. The Divinity, as the first and vital energy, has revealed himself from all eternity in an infinite variety of productions, yet continues always the same. Infinite, Immeasurable, Immoveable, and Unapproachable by any similitude. He is in all things and all things in Him, because by Him and in Him all things act and have their increase. He pervades the smallest portions of the Universe, as well as the infinite expanse; He influences every atom of it, as well as the whole. It follows that all things are animated, all things are good, because all things proceeded from good" (Tennemann's *Hist. Phil.*, Morel, pp. 266–7).

"The world in its external nature, as containing the development of all things, is but a shadow of the supreme principle. Its element is *matter*, as regards itself *formless*, but identical with the primitive and eternal form, it developes out of itself all accidental form." "By the multiplication of its own unity the first principle causes the production of multifarious beings, but at the same time that it is the source of species and individuals beyond all calculation. It is itself unlimited and unconfined by number, measure, or relation; it remains always one and in every respect indivisible, at once infinitely great and infinitely little. Inasmuch as by it all things are animated, the universe may be represented as a living being, an immense and infinite animal, in which all things live and act in a thousand and a thousand different ways" (*ib.*, p. 277),

"As the material world is but a shadow and reflection of the first principle, so our knowledge altogether consists in the perfectness of similitudes and relations; and as the first descending from its elevation produced, by multiplication of itself, the infinite diversity of natural objects, so do we gradually acquire the notion of unity by combining the multifarious" (*ib.*, p. 272).

[2] "Bruno opposes a dualism of matter and form; the form, moving cause, and end of organic beings are identical, not only with each other but also with the constituent matter of the organisms; matter contains in herself the *forms* of things, and brings them forth from within herself. The elementary parts of

The quotations do not present Bruno as a materialist. The form as being developed by nature is much like the germ theory as now presented. The views propounded by Bruno are very much the same as those of John of Erigena (John Scotus, 9th cent.), who, Henry Martyn, in his *History of the Druids*, says was a monk educated in an Irish monastery, wherein the traditions of the Druidical esoteric mysteries were preserved. John Scotus was deeply learned in these teachings, and to them were due both his theological and philosophical ideas, which mainly rest on the observed and admitted fact that every living thing comes from something which had previously lived.[1] On the authority of

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all that exist are the ***minima,*** or monads, which are to be conceived as points, not absolutely unextended, but spherical; they are at once psychical and material. The soul is a monad; it is never entirely without a body. God is the monad of monads; he is the ***minimum,*** because all things are external to him, and at the same time the ***maximum,*** since all things are external to him. God caused the worlds to come forth out of Himself, not by an arbitrary act of will, but by an inner necessity, hence without compulsion and hence also freely. The worlds are nature realized; God is nature working. God is present in all things in like manner as being the things that are, or beauty in beautiful objects" (*Uberweg*, article *Bruno.*)

[1] The visible world, being a world of life, has therefore necessarily emanated from some primordial existence and that existence is God, who is the originator and conservator of all. Whatever we see maintains itself as a visible thing through force derived from him, and were that force withdrawn it must necessarily disappear. Erigena conceives Deity as an unceasing participator in nature, being its preserver, maintainer, and upholder, and in that respect answering to the soul of the world of the Greeks. The particular life of individuals is therefore a part of the general existence, ***that is,*** of the mundane soul.

"If ever there were a withdrawal of the maintaining power all things must return to the source from whence they issued, that is, they must return to God, and be absorbed in Him. All visible nature must thus pass back into the intellect at last." "The death of the flesh is the auspices of the reinstitution of things and of a return to their ancient conservation. So sounds revert back to the air in which they were born and by which they were maintained, and are heard no more, and no man knows what becomes of them. In that final absorption, which after a time must necessarily come, God will be all in all and nothing will exist but Him alone." "I contemplate Him as the beginning and cause of all things; all things that are and those which have been, but now are not, were created from Him, and by Him, and in Him. I also view Him as the end and intransgressible term of all things . . . . There is a fourfold concession of universal nature—two views of Divine nature, as origin and end, two also of eternal nature, as cause and effect. There is nothing eternal but God. The return of the soul to universal intellect is designated by Erigena as Theosis, or deification. In the final absorption all remembrance of its past existence is lost" (Draper's *Conflict*, p. 126).

Tennemann, speaking of John Scotus, says, "He regarded philosophy as a science of the principles of all things and as inseparable from true religion. He adopted a philosophic system (a revised neo-platonism), of which the

Lange, Gassendi, the priest, the gentleman, and the scholar, is delineated. The address will speak for itself.

> Gassendi, "having formally acknowledged God as the great first cause, he immediately dropped the idea, and applied the known laws of mechanics to atoms, deducing thence all vital phenomena. He defended Epicurus, and dwelt upon the purity both of his doctrine and of life. True he was a heathen, but so was Aristotle. He assailed superstition and religion, and rightly, because he did not know the true religion. He thought that the gods neither rewarded, nor punished, and adored them purely in consequence of their completeness. Here we see, says Gassendi, the reverence of the child instead of the fear of the slave. The errors of Epicurus shall be corrected, the body of his truth retained; and then Gassendi, as any other heathen might do, proceeds to build up the world, and all that therein is, of atoms and molecules. God, who created earth and water, plants and animals, produced in the first place a definite number of atoms, which constituted the seed of all things. Then began that series of combinations and decompositions which goes on at present, and which will continue in future. The principle of every change resides in matter. In artificial productions the moving principle is different from the material worked upon, but in nature the agent works within, being the most active and mobile part of the material itself. Thus this bold ecclesiastic, without incurring the censure of the church or the world, continues to outstrip Mr. Darwin. The same cast of mind which caused him to detach the Creator from his universe, led him also to detach the soul from the body, though to the body he ascribes an influence so large as to render the soul almost unnecessary. The aberrations of reason were in his view an affair of the material brain. Mental disease is brain disease, but then the immortal reason sits apart, and cannot be touched by the disease. The errors of madness are errors of the instrument, not of the performer" (24–5).

There are no inverted commas in the text. How much of this tirade belongs to Lange, and how much to the speaker, does not appear; but this is clear, that the *insinuation*, to whichever it may be due, is that Gassendi was a hypocrite and an infidel.

Accepting the estimate of Gassendi's philosophy as it appears in the address we find the atomic theory with the idea and inception of a Creator, and that intellect or soul is not of the material body. The philosophy depicted soars above *that material* philosophy which is always attempting to degrade mind by making it a consequent of matter. He appears at the least to have distinguished that material substance was but the vehicle of effects, and was created.[1]

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foundation was the maxim that God is the essence of all things; that from the plentitude of His nature *first causes*, from which nature is begotten, are all derived from Him, and to Him ultimately return (*primordiales causæ natura naturans*).

[1] Gassendi was one of the most learned and eloquent of the writers and divines of his era (born 1592), an anatomist and an astronomer, and a vehement opposer of the Aristotelian theory, then predominant in the schools, and gave his aid to its overthrow. "He was the first observer of the transit of the planet

To continue (p. 26), the idea of Gassendi as enunciated "is substantially the same as that expressed by Professor Clerk Maxwell" (Bradford, 1873). According to both "the atoms, if I understand aright, are the *prepared materials*, which formed by the skill of the highest, produced by their subsequent interaction all the phenomena of the material world, the distinction between them being, the one postulates, the other infers his first cause." "In his manufactured articles, as he calls the atoms, Professor Maxwell finds the basis of an induction which enables him to scale philosophic heights, considered inaccessible by Kant, and to take the logical step from the atoms to their maker. Accepting here the leadership of Kant, I doubt the legitimacy of Maxwell's logic."

He continues: "But it is impossible not to feel the *ethic glow* with which the lecture concludes." This conclusion is the conception of a mechanical method.[2] By what possible process *morals*,

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Mercury over the sun's disc, previously calculated by Kepler." He had a controversy with Descartes. Baillet attributed the publication of "the doubts" to jealousy, "but the mind of Gassendi appears to have been superior . . to such paltry motives, and the origin of the work may be more justly referred to the love of truth." The abbé d'Estrées reconciled the two friends Descartes and Gassendi.

He was "a man of immense learning," a declared enemy "of whatever had the appearance of novelty, and was strongly biassed in favour of antiquity." "From Democritus and Epicurus, whose opinions were above all others most easily reconcilable to his own scientific information, Gassendi drew whatever was well founded and rational in their systems to form the basis of his own philosophy." He "restored the doctrine of atoms and a void," and divided with Descartes the empire of the French philosophical school.

The "*syntagma philosophiæ Epicureæ*," which followed "the *de vitâ*," was an attempt to reconstruct the system of Epicurus out of extant fragments, and to give a complete exposition of his theory. This work led "to a doubt of the sincerity of his religious belief," but eventually, however, "the injustice of the calumny redounded to the disgrace of his envious traducers" (died 1655). "The philosophic moderation of Gassendi has led Bayle to designate him as a sceptic . . . which, to judge at least by his writings, is little in accordance with the spirit of his philosophy." By the philosophical cast of his mind, as well as by the amiable moderation of his character, Gassendi was one of the brightest ornaments of his age. "Bayle has justly styled him the greatest philosopher among scholars, and the greatest scholar among philosophers. His works are distinguished by the perspicuous arrangement of the ideas, the justness of his reasoning, the acuteness of his criticism, and the pre-eminent lucidity of his style and diction" (*Eng. Encyc.*, vol. vi, col. 37–8).

[1] Helmholtz, who is no mean authority on German philosophy and metaphysics, says, "Kant's philosophy of identity was bold. It started with the hypothesis that not only spiritual phenomena, but even the actual world—nature, that is, and man—were the results of an act of thought on the part of a creative mind, similar, it was supposed, in kind to the human mind On this hypothesis it seemed possible for the human mind, even without the guide of external experience, to think over again the thoughts of the Creator to rediscover them by its own interior activity." If Helmholtz be correct in his analysis, Kant appears to have "scaled philosophical heights" transcending those of Maxwell's leap.

[2] Maxwell ends his lecture as follows: "Natural causes we know are at work which tend to modify, if they do not at length destroy all the arrange-

or any question of them, can occur in this connection remains as a monument of the astuteness of its discoverer. Quoting Lange:

> "When the great thought of one God, acting as a unit upon the universe, has been seized, the connection of things in accordance with the law of cause and effect is not only thinkable, but it is a necessary consequence of the assumption; for when I see ten thousand wheels in motion, and know or believe they are all driven by one, then I know that I have before me a mechanism, the action of every part of which is determined by the plan of the whole" (23).
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> "So much being assumed, it follows I may investigate the structure of that machine." "In other words, *were a capricious God* at the circumference of every wheel and at the end of every lever, the action of the machine would be incalculable by any methods of science. But the action of all its parts being rigidly determined by their connexions and relations, and these being brought into play by a *single self-acting* driving wheel, then, though this *last prime mover may elude me*, I am still able to comprehend the machinery which sets it in motion (*italics mine*). We have here a conception of the relation of nature to its authors which seems perfectly acceptable to some minds, and perfectly intolerable to others. Newton and Boyle lived and worked happily under the influence of this conception. Goethe rejected it with vehemence, and the same repugnance to accepting it is manifest in Carlyle" (24).

Why it should be assumed that a capricious God is at "the circumference, &c.," does not appear, unless it be necessary for the lecturer's theory. Both Goethe and Carlyle are known by their voluminous writing; do their works show the truthfulness of the imputation? Goethe, we learn from himself, was deeply tinctured with Spinozism.[1] This alone would be a disproof

ments and dimensions of the earth and the whole solar system. But though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems may be developed out of their ruins, the molecules out of which these systems are built—the foundation stones of the universe—remain unbroken and unworn."

[1] Speaking of Spinoza, Goethe says: "I well remember what peace of mind and clearness of ideas came over me when I first turned over the posthumous writings of this remarkable man." "Our physical as well as our social life, manners, customs, worldly wisdom, philosophy, religion, and many accidental events, call upon us to *deny ourselves.*" "We are continually putting one passion in the place of another—employments, inclinations, tastes, hobbies; we try them all, only to exclaim at last, *all is vanity.*" Some "men convince themselves of the external necessity, the immutable law, and seek to form to themselves ideas which are incorruptible, nay, which the observation of the perishable does not shake but rather confirms; but since in this there is something superhuman, such persons are commonly esteemed inhuman, without God, without a world."

"My confidence in Spinoza rested on the serene effect he wrought in me, and it only increased . . . . when I found Leibnitz himself did not escape the charge," nay, Boerhaave was supected of similar sentiments. The chief points I owe to Spinoza are, "Nature works after such eternal necessary divine laws that Deity Himself could alter nothing in them; in this belief all men are unconsciously agreed. Think only how a natural phenomenon which should of a material bias. Spinoza saw God in all things. Dean Stanley says, he of all authors gives the clearest definition of God. In a reflective mind there is a deep sympathy with the *illimitable* ALL; an inner chord is struck revealing the link-chain between man and his Maker. This is apparent in the thinkings of Goethe, and as for Carlyle, in the sonorous cadences of his text we seek in vain for the manifestation of this repugnance.

There is something more than science in the economy and "method of the world." Goethe "loved rather to consider Deity in, than beyond nature." We know only that of nature which observation discloses and find a harmonious relation of part with part, an absolute fitness of things, displaying a purposeness which dispels entirely the idea of fortuitous accident. The ancients knew but little of the divisions of physical science, nothing of the infinitesimal divisions of substances, nor of amalgamating principles. Water they knew as water, not as constituted of gases which have their presence everywhere in nature; not knowing these divisions, and not having surmised a law directing and governing, their formula was "the soul of the world."

Had Goethe felt the repugnance attributed to him he would not have failed to express it, and never would have retained the friendship of the celebrities of his time, some of whom were

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intimate any degree of understanding, reason, or mere caprice, would instantly astonish and terrify us." "When we see a man unreasonably opposing universally recognised moral laws against the interest of himself and others," to be rid of our repugnance, we convert it into censure or detestation," and "we seek either in reality or thought to be free from such a man." "The contrariety between reason and necessity Spinoza threw out in a strong light. I strangely enough applied it to my own being."

"If a natural universal religion were to arise and a specially revealed one was to be developed from it" (He considered the country of the patriarchs was fittest for its display); "even natural religion, even if it arose earlier in the human mind, there pertains to it much delicacy of sentiment, for it rests upon the conviction of a universal providence, which conducts the order of the world as a whole. A particular religion, revealed by heaven to this or that people, carries with it the belief of a special providence which the Divine Being vouchsafes to certain favoured men, &c. This faith seems to develope itself with difficulty from man's inward nature. It requires tradition, usage, and the warrant of a primitive time." "General natural religion . . requires no faith, for the persuasion that a great producing, regulating, and conducting being conceals himself, as it were, behind nature, to make himself comprehensible to us—such conviction forces itself upon every one. Nay, if for a moment we let drop the thread which conducts us through life, it may be immediately and everywhere resumed." "It is different with special religion." "This religion is founded on faith which must be immovable if it would not be utterly destroyed. Every doubt of such a religion is fatal to it." *Autobiography*).

sharply detained by a theological bias.[1] "The record of his life is the record of a sustained endeavour to solve a clearly perceived problem, to find the key to the mystery of existence, and to use it as the record of a success which may point the path and hold the lamp for all runners in the same great race."

As a naturalist, preceding or contemporaneous with Oken, he discerned the mystery of the skull's formation, and demonstrated that "in the plant, the eye or germinating point opens to a leaf, with the power of transforming a leaf into a radicle, stamen, pistil, petal, bract, sepal, or seed,"[2] and yet, according to Tyndall, "he could not formulate distinct mechanical conceptions, he could not see the force of mechanical reasonings, and in regions where such reasoning reigns supreme he became a mere *ignis fatuus* to those who followed him." In collating the works of Carlyle[3] the repugnance imputed to him eludes research. Could

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[1] To quote the words in the *Imperial Dictionary*, signed A. W. J. N., "Kiopstock loved him, Helder loved him, Wieland loved him, Schiller loved him. The cynic Mark, the fanatic Lavater, the savage Basedon, and the gentle Jean Paul, were similar only in their veneration and esteem."

[2] The doctrine that the flowers and fruit of a plant are altered leaves was dimly apprehended by Linnæus, initiated by Wolf, and independently enunciated by Goethe and the elder De Chandolle. When the nutritive organs of a plant are perfected it prepares for reproduction, the leaves become smaller, the flower stem shows itself and elongates, the flower buds follow, placed in the axial, or bracts, or as a small altered leaf.

[3] The second essay in *Past and Present* is entitled "The Ancient Monk," and is the history of a mediæval abbot. "The great antique heart, how like a child's in its simplicity, like a man's in its earnest solemnity and depth! Heaven lies over him wheresoever he goes or stands on the earth, making earth a mystic temple to him, the earth's business all a kind of worship; glimpses of bright creatures flash in the bright sunlight; angels yet hover, doing God's messages among men. That rainbow was set in the clouds by the hand of God! Wonder, miracle, encompass the man! he lives in an element of miracle, heaven's splendour above his head, hell's darkness beneath his feet, a great law of duty, high as these two infinitudes dwarfing all else, annihilating all else, making royal Richard small as peasant Sampson—smaller, if need be! The imaginative faculties; rude poetic ages; the primæval poetic element. Oh! for God's sake, good reader, talk no more of all that. It was not a dillettantism, this abbot Sampson; it was a reality, and it is one; the garment of it only is dead, the essence of it lives through all time and all eternity (*Past and Present*, chap. xv, peop. ed., p. 100).

In another connection he says, "The universe has *become* a humbug to those apes who thought it one. There they sit and chatter to this hour; only I believe every Sabbath there returns to them a bewildered half-consciousness, half-reminiscence, and they sit with their wizened, smoke-dried visages, and such an air of supreme tragicality as apes may, looking through those blinking smoke-bleared eyes of theirs into the wonderfulest universal smoky twilight and undecipherable disordered dusk of things, wholly an uncertainty, unintelligibility, they and it, and for a commentary thereon here and there an unmuthe exquisite irony and banter in which he indulges be mistaken? From his writings I gather he conceived God made the universe, that his work is the subject of a perpetual providence, and that he does not leave it as a clockmaker leaves a clock, to its own working.[1]

As the material philosophers construe,[2] so it is said man governs in the world apparently on the assumption that there is neither God nor providence, or if there be a God, he is considered but as an isolated fact in his own creation, to be invoked when a special purpose of the invoker is to be served.[3] Appeals are made by which superstitions may be enlisted for the furtherance of designs neither divine in conception, nor human in action.[4] Practically the providence of God

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sical chatter and mew—truest tragicallest humbug conceivable by the mind of man or ape. They made no use of their souls, and so they lost them. Their worship on the Sabbath now is to roost there, with unmusical screeches, and half remember that they had souls" (*ib.*, p. 131).

[1] A special reference is made to chapter v in *Past and Present*. In the work there are four chapters v. Was the professor aware that *Past and Present* is a compilation of essays?

[2] "For out of all this we call atheism comes so many other isms and falsities, each falsity with misery at its heels! A *soul* is not like wind (*spiritus*, or *breath*) contained within a capsule; the ALMIGHTY MAKER *is not like a clockmaker that once, in old immemorial ages, having made his horologue of a universe, sits ever since and sees it go.* Not at all. Hence comes atheism—come, as we say, many other *isms*, . . . sad root of all woes whatsoever; for indeed no man ever saw the above said wind element enclosed in its capsule, and finds it at the bottom more deniable than conceivable. So, too, he finds, in spite of Bridgewater bequests, *your clockmaker Almighty* an entirely questionable, deniable affair, and accordingly along with it much else; alas, no one knows what and how much else! for the faith in an invisible, unnameable, God-like present, everywhere, in all that we see, work, and suffer, is the essence of all faith whatsoever; and that One denied, or, still worse, asserted with lips only and out of bound prayer-books only, what other thing remains believable? That cant, well-ordered, is marketable cant, . . . the accursed, practicable quintescence of all sorts of unbelief" (*ib.*, p. 127).

[3] Kant held "the ideas of free will, Immortality, and Divinity, derive their certainty from the practical laws of ethics" as "a practical rational belief" (Tennemann).

[4] The quaintness of form which superstition sometimes takes appears in the following narratives.

Père Bernardin (who saw the documents in the monastery of St. Anthony) published in the *Nova Floresta* (Lisbon 1720) the records of a curious trial against the ants which infested the grounds of the monastery. He states the number of the ants had grown so prodigious that they stole the grain, invaded the buttery, and worked so deeply into the ground as to threaten the foundations of the building. After trying all expedients to rid themselves of the visitors, the monks in solemn conclave determined to cite them before the ecclesiastical tribunal. Accordingly advocates were appointed for the ants and the ecclesiastics. The advocates for the monks represented them as mendicants who led a sacrificing life in order to spread the benefits of religion and morality, their subsistence depending on freewill offerings expended in the purchase of food, which the vicious insects stole, and thus is reduced to the exigency of self. All this is an obstruction to culture, to the development of the true interest of the race, and a subversion of reason. Thus the moral tone becomes that which best subserves the prosperity of nations—a morality founded on strategy—and thus in the omnipotency of self, history becomes a bitter satire.

There is a peculiar idiosyncrasy observable in the address and the writings of the professor. God and matter appear as antagonistic principles, and, generally, the men who associate the idea of God with the works of creation, as Goethe and Carlyle, are accused of repugnance or are propounders of materialistic views. Bruno, such is the record of history, died because he would not deny his faith in his philosophy. Gassendi was the admiration of his class and of his time. Maxwell wants logic because he connects God with his atoms. Kant is appealed to; the whole tenor of his writings shows his cosmogony is framed in the idea of an existing God. "He sought to substitute for the argument from design an argument upon the abstract possibility of things." In his metaphysical elements, on an *à priori* analysis the elements which constitute matter are by him explained "under the conception

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the brethren were threatened with starvation, and in conclusion demanded they should be destroyed or banished. The advocate for the ants contended that as providence had created and endowed them with life they had the right to sustain themselves in whatever way their instincts suggested, and that although insignificant they taught man great lessons. They showed foresight in providing for their wants, were charitable, assisting each other in their work, and held stores in common, were religious, for they buried their dead, and showed *de facto* that the ants were the original possessors of the ground and the monks were the intruders, yet he conceded the monks had a right to use ordinary means to preserve their eatables, but had no right to cite them (the ants) before a religious tribunal. The judge ruled the monks must find and provide a suitable field in which the ants must take up their abode and that they were to retire there, and no further molest the monks. The work of the monks forbade their retreat, whereas the ants could find subsistence in any part of the country without inconvenience to themselves and damage to others. The judgment was pronounced in 1703, and proclaimed to the ants in due form. The sequel we do not learn.

A bull, 1314, at Mola, by Quarles of Valois, was condemned for murder and executed; the parliament of Chandaluer held the judge had no jurisdiction, and that, although the judgment was equitable, the judges were incompetent.

In 1266 a pig was condemned to be burnt at Fontenay aux Roses, for devouring a child (Abbe le Bouf). In 1408, at Vaudreuil, a pig was condemned to be hanged for killing a child in its cradle (Courtepée). In 1624, on the Kolenberg, a cock was burnt for having laid an egg, for eggs laid by a cock were supposed to hatch out basilisks, half bird and half snake (Kurser Baslib Chronik, Johan. Gross). In 1461, the Bishop of Macon solemnly excommunicated all the slugs infesting the diocese. In 1120, the Bishop of Laon excommunicated the mice and caterpillars which did harm in the district. At Autun, 1480, the vicars general anathematised the flies and blue bottles, enjoining the curates to repeat the curse until it proved effectual. In 1516, the caterpillars were excommunicated by the officials of Troyes, Champagne, the vicars general advising the people to become better, mend their evil ways, and above all to pay the church their dues at once (Condensed from *Daily Telegraph*).

of force, instead of the old traditional conception of solidity, impenetrability &c."

Martineau criticised the address (Manchester New College, Oct., 1874), and an effort is made to overwhelm him. After many comments of his own and attempts to prove that he (Tyndall) substantially gave utterance to the same idea as Du Bois Reymond at Leipzig, he says, "Martineau's ardour moreover, renders him inaccurate, causing him to see discord between scientific men where nothing but harmony reigns." It would be a pleasing fact to find this harmony, no doubt; we shall presently be told there is a harmonious relation between the ideas of Nägeli, Haeckel, and Virchow, at Munich (1877). We are bid to think that Bruno and Gassendi were materialists, as well might the charge be made against many of the writers of the *Bridgewater Treatises,* because they admit mechanics and chemistry as the methods of nature in the manifestation of design.

To go back to Mr. Martineau. The observations of a reviewer in the *New York Tribune* are cited with satisfaction:

> "The affluence of illustration (writes an able and sympathetic reviewer) in which Mr. Martineau delights often impairs the distinctness of his statements by diverting the attention of the reader from the essential points of his discussion to the beauty of his imagery, and thus diminishes the power of their conviction." "The excesses touched upon reach, far beyond the reader, to their primal seat and source in Mr. Martineau's own mind, mixing together *those* things that ought to be kept apart, producing vagueness where precision is the one thing needful, poetic fervour where we require judicial calm, practical unfairness where the strictest justice ought to be" (introduc., 2nd part, *Frag. Sci.* ed., 1876).

If an ill-natured critic desired to comment on the writings of Professor Tyndall in the latter part of the above paragraph, he could not, with some additions, find words more aptly to hit his salient points, both as a writer and as a lecturer. If we may judge by later productions, *e.g.* his contention with Dr. Bastian on the germ theory (*XIXth Century*, 1878)—he appears to exact the greatest courtesy towards himself, but exercises none towards those who *presume* to differ with him. What Martineau meets with Bastian and others have met with. Leibnitz and Carlyle are more gentle in their canons of criticism.[1]

The verses of Goethe's cited but imply he sees God in nature (24). Carlyle was an admirer of the *Fragments of Novalis*, would he to whom the idea of God was "repugnant" be so? (The whole of them are ideal abstractions, vide *Essays*, *Novalis.*) A broad, manly, and healthy tone, is traceable throughout the essays, and hence it is inconceivable that any one who *had read them* could have framed the imputation. They may be occasionally rugged, but they contain the teachings of a true thinker. Bishop Butler is parodied in a dialogue wherein the ideas are solely those of the speaker[1] (*no one who was acquainted with "the Analogy" could mistake them*). Had he lived in this day his readiness, reason, and thoroughness, would have dispelled the mists of materialism which cloud the scientific teachings of the time (Huxley). With the geologist and palæontologist he would have read "the riddle of the rocks," and with Darwin have seen the acts of a Creator in the works of creation, and would have shown its "technics" were those of intelligence, although he might have been puzzled what to make of the "*Ink of History.*" Darwin modelled a science from old world thoughts, aided by great and laborious researches. His observations and inductions have given a new dressing to kosmic ideas; or, as Max Müller says, "it is a new category, a new engine of thought, and if naturalists are proud to affix their names to new species they discover, Mr. Darwin may be prouder, for his name will remain affixed to a new idea, a new genus of thought" (*Sci. Lan.*) Darwin does not escape:

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[1] Leibnitz says, "When I err in my opinion of men, I prefer to err on the side of charity, and so, as regards their writings, I seek there what is worthy of praise rather than of blame, for there are few books, or persons, whence I may not in some form draw wisdom and instruction."

Carlyle says, "We are firm believers in the maxim that for all right judgment of any man or thing, it is useful, nay essential, to see his good qualities before pronouncing on his bad (*Essay*, Goethe).

> "Diminishing gradually the number of progenitors Mr. Darwin comes at length to one primordial form . . He quotes with satisfaction the words of a celebrated author and divine, who had gradually learned to see it is just as noble a conception of the Deity to believe he created a few individual forms capable of development into other needful forms, as to believe he required a fresh act of creation to supply the voids caused by the action of his laws. What Mr. Darwin thinks of this view of the introduction of life I do not know."

In his work, *The Origin of Species*, he states his idea.[2] The Professor continues:

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[1] It is evident the professor thinks highly of his material theory of mind, (31). He says, "I can imagine the bishop thoughtful after hearing this argument." An acquaintance with the text of the "Analogy" would suggest the answer, *corpus sanum, mens sana*, which liberally interpreted might mean water cannot flow in broken conduits.

[2] "Authors of the highest eminence seem to be fully satisfied with the view that each species has been independently created. *To my mind* it accords better with what we know *of the laws impressed on matter by the Creator*, that the production and extinction and present inhabitants of the world should have been due to secondary causes like those determining the birth and death of the individual." "Judging from the past we may safely infer that not one living species will transmit its unaltered likeness to a distant futurity." "As

"The anthropomorphism, which it seemed his object was to set aside, is as firmly associated with a few forms as the creation of a multitude. We need clearness and thoroughness here" (54).

Clearness, certainly; for when an accusation is made of "anthropomorphism," whether of "few forms" or of "many," what are we to understand? That these forms were all made in the likeness of God, for such is the meaning the word finds in Webster. There are but two views of nature, twist and turn them as we may. Spontaneity, this is denied; or a Projector, as an intelligent designer; for this we must look elsewhere than in matter. We are asked: "Divorced from matter, where is life to be found?" The answer is obvious. Life, as we know it—nowhere. But it does not follow, because our reasoning powers cannot pierce the arcanum of cause, *that there is nothing but that we perceive!* That life and matter are conjoined is true, but every thinking mind will demur when told." "Every meal we eat and every cup we drink illustrates the mysterious control of mind by matter" (54).[1]

If Lucretius, in respect of the atomic theory of Democritus and Epicurus, cut the knot of the ideal atoms "by causing the atoms to move together by a kind of volition," it was that he saw from a fortuitous movement it was impossible the phenomena of nature could ensue. If there be volition, there is an addition to matter—a something infusing energies; but if matter, "by its own intrinsic force," can generate will, it is that something of which there is no beyond.[2]

If matter be that which it is affirmed to be, vain are all teachings. All is the spontaneity of inaction. The great science of Harvey as to the circulation of the blood;[3] of Gilbert, that

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all living forms are the lineal descendants of those which lived before the Cambrian epoch, we may feel certain that the ordinary succession by generation has never once been broken, and that no cataclysms have desolated the whole world." "Thus from the war of nature, from famine and death, the most exalted object we are capable of conceiving, the production of the higher animals directly follows. *There is a grandeur in this view of life with its several powers having been originally breathed by the Creator into a few forms, or into one;* and that whilst this planet has gone cycling on according to the laws of gravity, from so simple a beginning endless forms, and most beautiful and most wonderful, have been and are being evolved" (6th ed. pp. 428–9).

[1] What never was seen nor heard of may yet be conceived; nor is anything beyond the power of thought, except what implies an absolute contradiction" (Hume, vol. ii, p. 23).

[2] Malpighi taught "*tota in minimis existit natura*, nature exists entire in leasts," "what is too small for the eye to detect we read in aggregates, what is too great in their units."

[3] "Harvey not satisfied with the external phenomena, or with the conjectures drawn from anatomy, laid bare the chest of a living animal, inspected the motions of the heart, and felt how it hardened in contraction and softened in diastole. His researches were followed up by Hales and Young. Harvey had not understood the

the earth is a magnet; of Swedenborg, who, in a particle of magnetic iron, discerned the quality which would generate the spiral motion of the sun and the planets; of Descartes, who saw in Gilbert's magnet, with its vortex, spiral motion and polarity, the leading thought that vortical motion is the secret of nature, which Linnæus affirms is always like herself—Heat, Light, Electricity, Life, Intellect, Will, with their varied formulæ and Consciousness; the mobility of method, the large application of Kosmology, and all else of the great and the little, the sun and the sand grain, become mere perplexities or amusing riddles.

All things are means to an end: heterogeneity merges into homogeneity, uniformity of action shows the ruling principle. Look at statistics—an accident, an enormity, an absurdity, a benefit, a prodigy in so many thousands, is always recurring, as if a calculator sat at the head of affairs repeating himself. We are all repetitions of that which has gone before, and yet with the uniformity there is variety and will. Will exists between the genesis and the ultimate, the beyond being crowned by an infinite reality; into this reality perception has no insight.

Faraday says there is always "a pusher and puller:" an authority, discerning in the methods of nature the purpose of an intelligent director.[1] Attraction and repulsion—whence are they? Perception says they are the inherent facts of nature, and so they are; but, beneath, conception finds an intelligent guidance, a law, a lawgiver.

Hume says, "Were men led into the apprehension of invisible intelligent power by the contemplation of the works of nature, they could never possibly entertain any conception but of one single being who bestowed existence and order on this vast machine, and adjusted all its parts to one regular system.[2] Butler said, "Our organized bodies are no more parts of ourselves than any other matter around us." Why so? Because he conceived the intelligence of man alone was the man, and illustrates his idea by saying, "we see with our eyes as

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return of the blood stream by the veins. It was reserved for the reasoning of Young, founded on the calculations of Hales, to show that the return of the blood to the aorta was due to pressure, in the same way as its arterial flow, not to a *vis insita* or some mysterious vital attraction" (Burdon Sanderson, *Harvian Oration*, 1878.)

[1] Who ever learns, by argument, the existence of invisible intelligent power, must reason from the admirable contrivance of natural objects, and must suppose the world to be the workmanship of that Divine being, the original cause of all things" (Hume, *N. H. R.*, p. 35).

[2] All things in the universe are evidently of a piece. Everything is adjusted to everything. One design prevails through the whole. And this conformity leads the mind to acknowledge one author" (Hume, *Dis. on Nat. Rel.*, p. 11).

but with our glasses, an intelligent factor beneath interpreting the result, and the like analogy may be concluded of all the senses."

Nature selects, and material consequents follow. Forces are facts acting as units on masses; presented as energies they compel conclusions—this is nature, the selection is but the working of law. No doubt Darwin drew heavily on credulity when he proposed his *Theory of Pangenesis*, but what rearrangements in the newness of hypothesis do not? We are often startled by presentments which after-observations verify. A microscopic germ contains within itself a world of other germs. The motion of a planet is true of all other planets. The broad principle elicited from facts shows the competence of force to bear the strain imposed as regards divisibility and distribution.[1] By reasoning on the facts we find the roots of life in the primordial germ, within which is the richness and variety of phenomenal life; and the perfected organism—man. We must look behind the germ to discover the impulse of his genesis.

If matter controls mind (34), with the same logic it may be said, because the steam-engine was constructed in accordance with the relative laws of force, that therefore it was its own constructor. It might be said Watt created its parts; certainly he, *as other experimental machinists have to do*, *created his tools*, and so nature, not only adapts but creates the material she possesses. Not all the "matter" in creation, without the intelligence of Watt, would have grown into a steam-engine. Helmholtz says, "Whatever of the actions of intelligence we meet with in the world of machines is due to the mind of the constructor." In nature, unless there were an intelligence within or behind, there never would have been developed its forms, varieties, and beauties.

In the work, *The Glaciers of the Alps*, our annotator derides the thought that the beauty of the world was made for man. Notwithstanding Darwin's idea—probably no more than an idea—that creatures have an appreciation of colour and form, and are guided in the selection of their mates by this quality,[2]

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[1] All things in the universe are evidently of a piece. Everything is adjusted to everything, one design prevails through the whole" (Hume, *Nat., Hist. of Rel.*, p. 11).

[2] Wallace dissents from Darwin's theory that the beauty of the males is for the females' selection, and answers that colour is a sign of vigour, and the most vigorous birds are selected by the females, or he conquers his rivals in her favour. "Colours are fixed or modified in animals by natural selection for various purposes; obscure or imitative colours for concealment; *gaudy colours* for a warning that the animal *is not good to eat*, and so is not worth killing; special markings for easy recognition, or to divert attention from vital parts" (*Trop. Nat*).

Remark.—Parrots are "gaudy" birds, and so are pheasants; guinea fowl are beauif this were proved, it would count for little as a general fact; so, disregarding its implication, and on the assumption that everything has its use, it is rightly inferred that the beauty spread around in objective phenomena was intended to satisfy a mental faculty. (*Vide supra*, note, p.151). If there be those who by a reach of ideal sympathy can elevate the phenomenon into a work of an appreciative providence the better for them. As our professor would be so *scientifically severe*, so logical in expression, we may ask what he means when he says, "Nature lays her beams in music." To what scientific fact does he refer as the basis of his idea? In the absence of explanation it is difficult to understand what "beams" in nature develope the music "to be heard by mortal ears." If there be such a fact it appears alone known to him; therefore we may hope soon to have a chorus of the spheres running the range of the gamut in rythmic measures, probably a celestial harmony adapted to Addison's lines:

"For ever singing as they shine.
The hand that made us is divine."

What a telegrapher and his tools, as an analogy, has to do with mental phenomena, unless by showing without competent conduction no result could follow, is beyond me (30). The wires and implements, needles and magnets, without an intelligent direction, would never formulate an intelligent message. It is the same with mind; the brain and the nerves are the conducting apparatus both of sensation and of will. Cut the nerves, break the wires, demagnetize the needle, and there would be no conduction, yet the electrical power is still existing. It is the same with mind, the conductors are merely auxiliaries. It is idle to infer a distinction because, in the one case, the operator is without the apparatus, and in the other, the operator and the apparatus are within. The true points are the electricity and the mind. To confuse the thing with the factor of the thing is to throw aside all rules of logical induction. There is no need to shut our eyes to the mystery of the brain (*note* 1, *p*. 44) or other organized formations, they are all mysteries. We may talk learnedly of corpuscules, germs, and masses of plasma, but we never get into the interior fact. We know them to be vehicles through

tiful by their markings; other coloured birds may also be named as good for the pot. The peacock was a crowning dish at the feasts of the ancients. Colour is an integral in matter; its secret, whether in the irridescence of inorganic substances or in organisms, is not yet discovered. There is some law, but what is that law? We are not answered when it is said "Colours, again, are influenced by food, by the action of light, and by the peculiarities of the soil, and they are intensified by the extension or modification of the integument and by the surplus of vital energy, as at breeding-time" (*ib.*).

which different effects are made manifest, vitality one principle, mind another; the two comprising dual man, life and intellect, the impulsed and the impulser. Life, we know, is for ever subsisting, as shown in the recuperative power of organic particles, and by a parity of reasoning we have the right to assume the same energizing power in mind. *There cannot be annihilation!* (*sup.*, *p.* 147.)

Mind is dependent on nutriment only so far as the organs of conduction require sustaining, but we are told it shows "the mysterious control of mind by matter;" if this be logical or biological reasoning it were well to have done with both. Such logic is made the stalking horse of many an absurdity. Each fact of mind and of physiology is antagonistic to such a conclusion. Trace the line of life backwards as we may we find life, but never the whence of life; we find the bed whereon it reposes, but the initiation of combination resulting in animation eludes research. We find mind, or that which Huxley supposed to be its fundamental basis (*Lecture on Biology*), in every phase of organism. Lucretius, by the necessity of reason, adopted volition, seeing that atoms left to their own action could never cohere, and would remain for ever inert. Admitting, as undoubtedly we must, that from the womb of nature all organisms proceed, it shows the exigency to produce, but does not show an ingeneration uninfluenced by a cause. Ingeneration is the exigency of phenomena.

That man bears with him "in his organic form" the mark of an hereditary descent is an everyday observation, verified by the Bourbon and Hapsburg characteristics; does intellect follow the same rule? It is rare to find the son inheriting the intellect of the father, and more rare to trace it in a long line of descent. The distinction between organization and intellectuality consists in that the first reacts on and reproduces itself, the latter accumulates through culture, innately possessing *the potence*. It cannot be said that there is the hereditary transmission of high mental characteristics. Consciousness, complete in itself, is impossible in disintegration (*vide* p. 9). In its collective expression, in its passive impressiveness, it comprehends and contains all things. To it there can be neither time nor space, for there can be nothing where it is not.

In the *Times* report of the address we have the pith of the conclusions. "Abandoning all disguise the confession I feel bound to make before you is that as I prolong the vision backwards across the boundary of the experimental evidence and discern in that matter, which we in our ignorance and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobium, the promise and potency of every form and quality of life."[1]

This was not a mere *ad captandum* ebullition due to the excitement of the moment, but, as we are told, "a deliberate conclusion arrived at in moments of seclusion;" we are then bound to accept it as the settled opinion of its enunciator. Thus looked at, it is the assumption *that Matter, as Matter directly* and *solely, is the cause of all things*, going beyond the Pagan Lucretius, who admitted volition. The Creator for whom is a *professed* reverence becomes a mere accidental inference. Looking, then, at this announcement as the settled conviction of the speaker, unbiassedly judged, it is a confession of materialism in its extremest form, and as such has generally been accepted. If this conclusion be denied we have speculation and only speculation, and yet we have the assertion that "before Virchow laid down his canons I had reduced them to practice!" (*XIXth Cent.*, March, 1878, p. 50).[2]

In later editions, the seventh thousand, there are important variations. We there read:

> "Believing as I do in the continuity of nature I cannot stop abruptly where our microscopes cease to be of use. Here the vision of the mind authoritatively supplements the vision of the eye, by an intellectual necessity, I pass the bounds of experimental evidence and discern in that matter which we, in our ignorance of its latent powers and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of all terrestrial life" (55).

What conclusions are to be drawn from these conflicting versions? The original version has no distinction, "*every form and quality of life*. Intelligence and spiritual affinities are qualities of life as we know it. If mind[3] be but a material consequent, "*once existing in the fire mist*," and spirit an unmeaning assumption, we have the hypothesis, and with it all its inferences. A modification is presented—"all terrestrial life." Can it be supposed that it has dawned on the mind of the professor that there is a life other than the *terrestrial life?* If such be the new conviction it should be avowed. If not, why was the alteration made? There is but little satisfaction to be gleaned in the observation "that the materialism here professed may be vastly different from that *you* suppose." Anything *may be* when suppositions are indulged in. The proposition before an assembly representing the science of England *should be this is*, and the *this is* should be supported by observation and experiment, or Huxley's idea that "science is trained common sense" vanishes in "scientific imagination."

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[1] "The existence of any being can only be proved by arguments from its cause or its effects, and these arguments are founded entirely on experience. . . . 'Tis only experience that teaches us the nature and bounds of cause and effect, and enables us to infer the existence of one object from that of another (*In note*, he says), "That impious maxim of the ancient philosophy, *ex nihilo, nihil fit*, by which the creation of matter was excluded, ceases to be a maxim according to this philosophy" (*Hume's Essays*, vol. ii, p. 258).

[2] A little philosophy makes men atheists; a great deal reconciles them to religion" (Bacon).

[3] Although all knowledge reposes on sensation, yet the ground of all knowledge is intellectual. In the verification by sensation, it is the intellect which doubts, criticises and judges. We continuously employ conception as to number, being, substance, cause, &c., without being merely imaginative (*vide* St. John Mivart, *Genesis of Limbs*).

The mischief of the whole thing is that unscientific readers are led into an intricate maze of unconditioned thought, with no clue to guide them out of it. Saying that Mill "reduces external phenomena to possibilities of sensation," that Fichte, "having first by the inexorable logic of his understanding proved himself the mere link in the chain of external causation which holds so rigidly in nature, violently broke the chain by making nature and all that it inherits an apparition of his own mind" (57) [his formula was[1] *Ego*, *sum Ego*]; or by Herbert Spencer saying, "Our states of consciousness are mere symbols of an outside entity which produces them and determines the order of their succession, but the real nature of which we can never know," are neither reasons nor answers. He (Tyndall) affirms, "We can trace the development of the nervous system and correlate with it the phenomena of sensation and thought."[1] The nerves are the conductors by which the expressions of sensation and thought are conveyed. This was the opinion of Bell and is that of Carpenter, and, as far as I can gather, of all other reasoning physiologists, but how are the nerves correlated? We might as well say the river is correlated with its channel, or the sea with its basin. We hear also "that there are such things woven into the texture of man as awe, reverence, and wonder" (60). We are lost in conjecture. What are we to understand? The texture of man consists of organic compounds. We have words without meaning, for the assumption then would be that "matter" has conceptions of Deity.

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[1] Fichte, speaking of the poet, says: "There is a divine idea pervading the visible universe, which universe is, indeed, but a symbol and sensible manifestation, having in itself no meaning, or even true existence, independent of it. To the mass of men this divine idea of the world lies hidden; yet to discern it, to seize it, and live wholly in it, is the condition of all genuine virtue, knowledge, freedom, and the end, therefore, of all spiritual effort in every age. Literary men are the appointed interpreters of this Divine idea—a perpetual priesthood, we might say, standing forth generation after generation as the dispensers and living types of God's everlasting wisdom, to show it in their writings and actions in such particular form as their own particular times require; for each age, by the law of its nature, is different from every other age, and demands a different representation of the Divine idea, the essence of which is the same in all, so that the literary man of one century is only the mediation and interpretation applicable to the wants of another; but in every century every man who labours, be it in what province he may, to teach others, must first have possessed himself of the Divine idea, or at the least be, with his whole heart and whole soul, striving after it."

Carlyle says: "We state Fichte, as he is known and admitted by men ot all parties among the Germans, when we say that so robust an intellect, a soul so calm, so lofty, so massive and immovable, has not mingled in philosophical discussion since the time of Luther. We figure his motionless look had he heard this charge of mysticism! for the man rises before us amid contradiction and debate like a granite mountain amid clouds and wind" (*Carlyle's Essays*, vol. i, p. 94).

> "There is also that deep set feeling which since the earliest dawn of history, and probably for ages prior to all history, incorporated itself into the religions of the world. *You* who have escaped from these religions into the high and dry light of the intellect may deride them, but in doing so *you* deride accidents of form merely and fail to touch the immovable basis of the religious sentiment in the nature of man. To yield to this sentiment reasonable satisfaction is the problem of problems at the present hour" (60).

If mind be a material consequent whence is "the religious sentiment?"

Perhaps a more extraordinary use of the pronoun you was was never made. Were *his* intelligent listeners materialists and he alone free from its taint? Are we to conclude that *he* only possessed the religious sentiment (elsewhere called an emotion)?[2] but which with his hearers had perished in "*the high and dry light of the intellect?*" Courtesy should have suggested the pronoun *we*. Religion, whether it intrudes into "the region of objective knowledge" or not, is "capable" of something more than "poetry and emotion," however they may add "to the inward completeness and dignity of man." If man, intellect, and organism, be mere matter from whence is this dignity derived?[3] The rock would have the same exaltation. When the mind is saturated by a particular idea it is like looking into a concave mirror of unequal densities, which distorts every object it reflects. It is like a man facing the west, he goes on for ever and ever, and never reaches the east; face about and the problem is solved. If matter be both cause and effect, subject and object, why was man made intelligent? In such category culture would be a meaningless absurdity, the religious sentiment would be rightly termed an emotion, God a non-entity, and all our conceptions inexact speculations ending in annihilation, morality a mere fetter on opinion and the gratification of passion would take the place of mental abstraction; thus, in intelligence and life there would be neither reality, object, nor purpose. Goethe has aptly said, "*Every bird has its decoy and every man is misled in a way peculiar to himself.*"

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[1] If each animal function, even reproduction, can be explained, as Lankester and others assert, by physico-chemical means, why also is it not explained how inorganic substances obtain their various structures and powers? Milne Edwards, on this point, says, "These arose *de leur co-ordination sous l'émpire d'une force puissante commune, d'un plan préconçu, d'une force pré-existante.*"

[2] If the idea of the professor be that religion is *an emotion*, and the idea of God *a feeling*, we can expect no sufficing notice of such a being. In the controversy with Martineau, speaking of the power manifested in the universe he (Tyndall) says, "I dare not, save poetically, use the pronoun He regarding it. I dare not call it a mind and refuse to call it a cause" (introduc. 2nd part, *Frag. Sci.*). We have, then, but an imaginative phantom existing apart from an ideal, if *it* be not considered as a person, a cause, or mind, or being. There is no such vagueness of expression when matter is spoken of.

[3] The greatest part of mankind are naturally apt to be affirmative and dogmatical in their opinions; and whilst they see objects only on one side, and have no idea of any counterbalancing arguments, they throw themselves precipitantly into the

The mythic New Zealander, the philosopher in the ages to come, if he should meet with the address, in his astonishment would demand was it accepted by an association of science, comprising the highest names of the day, as a summary of the philosophy of the time, as a logical deduction from the science of the 19th century? If so, then the era to which Huxley and Haeckel both confidently look, when scientific thought is to reign supreme, will be indefinitely prolonged. Better theological dogma and its extreme definitions; at least there is the gain of an acknowledged (however indeterminately formulated) God. Whatever may be the idolism of the address, theology is an idealized idolism, whatever more it may be. In cultured minds the religious idea generally terminates in a God or cause; an evidence, although negative, which must count for something in the cognition of a reality, not of matter, but of the manifestation of a principle, at once unifying and preserving—Matter is perceived, Mind thinks.

So enslaved is the general mind by the authorities of the time that it is assumed to be treason to doubt the dicta of the leaders of the day, talk what or how they may—absurdities become logic; sensationalisms, eloquence; fanaticism, patriotism; and prose run mad, poetry; all because at some time in their era, they have earned a name for *some themes logically reasoned*, *for some experiments successfully conducted*, *for some political conduct ably directed*, *and for some poems admirable and artistic.*

Without bias I entered upon and so far have completed my task; what I had to say it was necessary to say plainly, as I cannot but think the address is a pitfall for the unwary, and a

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principles which they are inclined to; nor have any indulgence for those who entertain opposite sentiments (*Hume's Essays*, vol. ii, p. 253).

snare to the unthinking. If the no God hypothesis be truth, then I have contended against the truth. Liberty of discussion and the free expression of opinion is the privilege of the time: but it were well to listen to the warning of the great German philosopher and not permit liberty to generate license. The names of Bruno and Gassendi, *who were no materialists*, are made the stalking horses of a materialistic propaganda. Equally unfortunate in selection were those of Goethe and Carlyle; as well Servetus and Bishop Berkeley, Dean Stanley and Mr. Martineau might have been chosen. The desire has been carefully to avoid wounding susceptibilities; and although the speech may be plain, the critical canon of Leibnitz and Carlyle has been adopted rather than that so unflinchingly acted upon by the Professor in his comments on Martineau, Bastian, and others. By the principle pursued throughout the address, it could be shown from the Psalms "there is no God," by leaving out the trifling context, "The fool hath said in his heart."

THE BIRMINGHAM ORATION.

At Birmingham (1877) Tyndall delivered an oration, the keynote of which is that the *Unknown* should be interpreted by the *Known*. The difficulty meets us, what is the known and what is the unknown? Every known contains the unknown; where, then, are we to find the simple known? The known is assumed to be the perceived. The unknown is an abstraction arising out of the known, or having an origin independent of the senses. Science is but a plausible explanation of the methods of nature based on infinitesimals, whilst philosophy is the science of principles, an outgrowth of mental conception improved by culture.[1] We know matter as a vehicle for the presentation of effects, and that all objective phenomena can be reduced to the gaseous form, and thus become imperceptible to the senses. We do not know *why* this gaseous state should exist. We do not know *the why* of objective forms, or the ultimate processes of their amalgamation. We know that life is always ready to intrude, but we do not know in what the life consists. It is no explanation to say that life is perfectly presented in atmospheric

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[1] "Now-a-days, in the most widely-read journals, daily, weekly, monthly, and quarterly, it is being preached that faith is a hallucination or an infantile disease, that the day for religion is over, that the gods have at last been found out and exploded, and that, there being no knowledge possible save what comes to us through the senses, we must be content with finite things, and strike out from the dictionary of the future such words as infinite, supernatural, divine" (Max Müller, *Fifth Hibbert, Lect.*).

(*i.e.* invisible) germs. It is as easy to conceive them imperfect,[1] and that these germs, if there be such things, are imperfect life vesicles which receive completion through substances not existing in their composition. Animals and plants attain to fruition by the contact of substances foreign to the individual, and also by a new admixture of substance. Life only appears when all conditions are satisfied. Thus an odour may contain parts of the protoplasmic substances, perfected when it impenetrates the secretions, changing their form, as animal heat changes the condition of the egg. *As the known cannot interpret the known*, it then seems idle to insist *on an interpretation of the unknown by the known.*

After a number of commonplace summaries, speaking of evaporation, Tyndall says, "Up to the point where condensation begins, an amount of heat exactly *equivalent to the molecular work of vaporization and the mechanical work* of lifting the vapours to the mountain tops has *disappeared from the universe.*" What, then, becomes of the principle enunciated in the hypothesis of the conservation of energy? Wasted heat is a dogma of the Professor.[2] There is no disappearance of heat from the universe if Joule has truly propounded his theory. *The heat converted into work is stored in the work*, to be reinduced as the work is undone; in other words, the energy is always existing in quantity, but changed in its application. Presently we hear, "Every rain-drop which smites the mountain top produces its definite amount of heat; every river in its course developes heat by the clash of its cataracts and the friction of its bed." Whence was this heat? Is it not that heat *which had disappeared from the universe?* (the work giving back the energy stored in the vapour!) As to the sun hypothesis of Mayer, Helmholtz, and Tyndall; the sun may be the storehouse of heat,[1] if it be heat, *it is not heat as science defines heat:* the rule of *the inverse square* interposes its fiat. If the sun acts on the earth and the other orbs of his system, it is by virtue of a principle of which the correlated forces are conditions.[2] All change is the transmutation of energies, because such is the method of nature. Nature is prodigal of power, but sparing of substance; there is no room *for waste.* Truly it is written that knowledge is surrounded by a boundary which marks its limit, but the material hypotheses have shrunk far from this limit. We have the catastrophism of language when we are told the saying of Mayer, "that the nerves pull the trigger, but the gunpowder they ignite is stored in the muscles." The chemistry and mechanics displayed in nature may be freely admitted, as they show the vastness of the intelligence of the inducing cause. After more elementary science, to introduce Lange's story of a merchant convulsed into action by a telegram,[3] &c., Tyndall says:

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[1] Dallinger and Drysdale's examination of minute organic forms appears to have a bearing on this question. Speaking of the coalescence of two forms, they say the creature could only move in a straight line, and "comes in contact with a colony of the organism in a springing condition, attaches itself to one of them, which then soon unanchors, and both swim away. In the course of time their movements become sluggish, the *sarcode of their bodies is palpably blending*," changes then take place, and spores are exuded, "exquisitely minute, opaque, apparently round specks, were seen to develop into the adult form and size" (Paper read before the Royal Society, *Life Hist. of a Minute Septic Organism*, vide *Nat.*, vol. 18, p. 103).

[2] In the intangible and imponderable is found the real, because they are always subsisting and universal. A realm of life is found in the entrails of the fly; the fly dies, but the world within does not die—the life of this microcosm is translated into spores, wherefrom new energies arise, and a new life appears. When heat disappears it re-appears. What, then, is the meaning to be attached to such phrases as "wasted heat" and "degraded energy." If worlds fade or decay, in continuity is found their germ of rehabilitation. Nothing is known of worlds destroyed. If there were wasted heat there could be no continuity, and the universe would imperceptibly fade, unless it can be said heat interbreeds heat, hypotheses beget hypotheses, in the same way as magnitudes grow out of littles, magnitudes being but multiples of littles infinitely repeated. The physicist recording by analysis magnifies his littles, and in "*imagination*" unthreads and holds in his grasp the universe, and thereby supposes he annihilates *the great beyond*. In perception there is but instinctive aptitude; in conception the reality of knowledge.

> "This complex mass of action, emotional, intellectual, and mechanical, is evoked by the impact upon the retina of the infinitesimal waves of light coming from a few pencil marks on a bit of paper. We have, as Lange says, terror, hope, sensation, calculation, possible ruin, and victory compressed into a moment."

After an observation on nervous action, and saying the impulse arose from "the centre of the nervous system," he asks, but "how did it originate there?" "This is the critical question. The aim and effort of science is to explain the unknown in the terms of the known."

Spencer, "the apostle of the human understanding" (*Belfast Add.*), says (*First Principles*, p. 37), "We cannot think at all about the impressions which the external world produces upon us without thinking of them as caused; and we cannot carry out an inquiry concerning their causation without inevitably committing ourselves to the hypothesis of a first cause." Carpenter (1872) says, "Even in astronomy . . . we cannot proceed a step without translating the actual phenomena of nature into intellectual representations of these phenomena."

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[1] No particle of vapour was formed and lifted without being paid for in the currency of solar heat; no particle returns as water to the sea without the exact quantitative restitution of heat (*Birmingham Lecture*).

[2] The experiments of A. N. Mayer with the floating magnets, and the remarks by C. N. Pierce on their action (vide *Nature*, vol. xviii) if pursued and examined in relation to the planetary spheres, together with observations on the rule of the inverse square as to distances, probably would be shown that which is the true application of the energy of the sun, and how this energy is transposed as correlated force by the economy of nature.

[3] As a surface presentment this is all plausible. The exciting fact was the idea presented in the letter, which, when received in the mind, affected the mind. The same result would have been brought about by any other mode, or by *vivâ voce* speech. How can it be said "the terror, &c. &c., was evoked by impact on the retina of infinitesimal waves of light," &c. &c.? The inference is specious in reason and false as an induction. The symbol of any object excites the mind, and when certain associations are connected with it, has been known to drive an individual to frenzy.

Tyndall continues, Some may be disposed to press on me such considerations as these:

> "Your motor nerves are so many speaking-tubes through which messages are sent from the man to the world; and your sensor nerves are so many conduits through which the whispers of the world are sent back to the man. But you have not told us where is the man. Who or what is it that sends and receives those messages through the bodily organism? Do not the phenomena point to the existence of a self within the self, which acts through the body as through a skilfully constructed instrument? You picture the muscles as hearkening to the commands sent through the motor nerves, and you picture the sensor nerves as the vehicles of incoming intelligence; are you not bound to supplement this mechanism by the assumption of an entity which uses it? In other words, are you not forced by your own exposition into the hypothesis of a free human soul? That hypothesis is offered as an explanation or simplification of a series of phenomena more or less obscure. But adequate reflection shows that instead of introducing light into our minds it increases our darkness. You do not in this case explain the unknown in terms of the known." *This* enables him to ask "what is the causal connection, if any, between the objective and subjective, between molecular motions and states of consciousness? My answer is I know not, nor have I as yet met any body who knows.[1] It is no explanation to say that the objective and subjective effects are two sides of one and the same phenomenon. Why should the phenomenon have two sides?"

He says we can present to the mind the physical process of nerve actions, but none by which consciousness acts; that "molecular motions produce consciousness," but "the reverse process of the production of motion by consciousness is unpresentable to the mind." It may be said the image in the looking-glass is exactly analogous. He continues: "If we are true to the canons of science we must deny to subjective phenomena all influence on physical processes;" in other words, denying *intel-*

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[1] "They had heard his 'Yes' to the question, Are the senses ever brought into contact with the Infinite? For beyond, behind, beneath, and within the Finite, the Infinite is always present to our senses, pressing upon us, growing upon us, from every side. What we call Finite in space and time, in form and word, is nothing but a veil or net thrown by ourselves over the Infinite. The Finite by itself, without the Infinite, is as impossible, as inconceivable, as the Infinite without the Finite. As Reason deals with the finite materials supplied to us by our senses, so Faith deals with the Infinite underlying the Finite. The history of the ancient religions of India is, in fact, a history of the various attempts at naming the Infinite that hides itself behind the veil of the Finite" (Max Müller, *5th Hibbert, Lecture.—Times'* rep.).

lectual action in nature. He breaks off without any solution or attempted solution of the soul question and the subject of necessity.

It is clear there can be no molecular motion without an antecedent motion in "the prepared brain." When this antecedent motion is accounted for, we have the connection between the subjective and the objective. In purely physical matters, in the union of the oxygen and hydrogen (water), we have the same difficulty of explanation as in the union of the mind and the organism. It seems an absurdity to demand an explanation of the highest metaphysical problem when the ultimate reason for the union of the gases forming water cannot be answered by physical science. If we say water is a metallic oxide (the extreme assumption), what nearer are we to the reason for the oxidation of the hydrogen element, or for any metallic rust? Why have we a life-supporting fluid formed by the union of two gases individually incapable of supporting life? It is the same with air—pure nitrogen breathed into the lungs is death; the same with salt—chlorine and sodium individually are death-givers. When physicists can answer these questions, when they can interpret the *known* by the *known*, it will be quite time to *demand the unknown should be interpreted by the known.* In both there are ultimate facts of which science is supremely ignorant. It is Nägeli's axiom being answered by that of Du Bois Reymond.

All questions of physics are known by effects occurring in the due course of the laws governing them; all facts of mind (to us) are equally effects and occur through their governing laws. To my mind—and all phenomena point to this end—there is a vital energy pervading all nature, inorganic and organic, and to this energy all phenomena are mediately due, even the "frost ferns on the window," and this molecular motion of which we hear *ad nauseam* is but a phase of the vital energy. The spontaneity which presents life on earth, the parent of all phenomena, is vital energy, a servant obedient to the antecedent impulse, the result of the primordial intelligence. This is no proof, but we find the proof in the chain of effects resulting from a single impulse. Hume, however unjustly in his day termed an atheist, adduces abundant testimony to the incontrovertibility of this fact.

It is easy to present *Whys* and to get *Whys* in answer, for the why of the one presents the same difficulty as the why of the other. But when we are told, "I think posterity will acknowledge, in the history of science, no higher samples of intellectual conquests are recorded than those that this age has made its own," we naturally inquire, What are they?[1] Where have we explanations of principles or of ultimate forces, if we except the doctrine of the correlation of the forces (*the grandest philosophical conception of the century, the key-note to the Methods of Nature*), although the cause of the interconnection of the forces will probably be for ever hidden. Evolution is the adaptation of previous science enforced by research. The age has been peculiarly rich in infinitesimal discoveries. We have in the conservation of force or energy hypothesis, the expression of the economy of nature. Where are we to turn for the explanation of what may be a causal fact? In the face of the labours of Davy and Faraday, where in England are we to look for the extension of the principles of chemical and electrical knowledge? of which, in many features, they may be said to be the pioneers? They can scarcely be claimed as denizens of the age, whatever they may be of the century. They have worthy followers in Continental and American chemists and electricians. A long string of names of practical adapters may be adduced, making a surface history of science, which can be gleaned from any cyclopædia. We have illustrators, not discoverers. Bell, Edison, and Hughes may claim a higher place; their combined discoveries show a causal connection, making an indefinite idea a definite fact. The discoveries of the time can rank but as explanations of the methods of nature, and can only be interpreted by their collective impact in the same way as science exists in the mind. That collective energy which in nature is illustrative of intelligent purpose, in man is a process of culture. In man we have a possibility, in nature the collective actual, and these intelligences, by the new school philosophy, are claimed as material causes! This material explanation pervades the whole matters in comment. We have the subtle interweaving of a few surface facts of physical knowledge which inferentially are assumed to be explanations of vital and mental powers; but to one who could suppose that intelligence and life were contained in the fire mist, assumptions and hypotheses may easily be made to take the place of principles and facts, whereby "all forms and qualities of life" become but emanations of inert matter. The subjects of the discourse, as matters for discussion, are wholesome exercise, but when subtly presented as problems to catch assent they become as unwholesome as they are untrue scientifically.

If the objective and subjective are said to be two sides of the same phenomena, he asks, "Why should the phenomena have two sides when there are plenty of molecular motions which have not this two-sidedness?" A tyro would answer the question by saying that contrast is the method of nature; that effects act on effects, the causing and the caused, and that out of this category there are no molecular motions. Even the particle in its polar fact has two sides or forces. We find everywhere in nature the subjective resulting in the objective. There is neither mechanism nor chemistry in nature or in art without an underlying subjective intelligence, although physical science offers no justification for the notion that molecules can be moved by states of consciousness, nor for the movement of molecules without a preceding force! Nowhere in the books do I find it asserted that consciousness is a motor force (consciousness has no energies, therefore can have no states), whatever intellect, as represented by will, may be. Whatever answer may be given for any material or objective consequent has equal force when applied to vital and mental facts. In all cases the motor power is an imponderable something, be it force or be it intelligence, and in all cases the ultimate motor fact is hidden, or at least science has not discovered it. We are surrounded by positive facts which by the finite mind are indefinitely conceived. The effort to make the indefinite definite is the basis of the material hypothesis. The idea of Epicurus as to the fact of cohesion, is scientifically expressed in Faraday's idea of a single force, so definitely proved by Grove in his daguerreotype illustration (*supra n.* 2, p. 9). There is no more mystery in the connection between mind and matter than there is between force and matter. The most insignificant production of earth is as much a mystery as an idea, all await solution. We know facts as effects, but we do not know the ultimate cause of these effects. The phantom which the lecturer has set himself to combat arises from his own assumption that the molecular action of the brain *is the cause* of consciousness and intellect. The arrangement of the amorphous substance constituting the brain is probably so purposed as to act as a mirror for the impression of symbols, sensation and intelligence being the inducers of the molecular changes which receive their interpretation by the action of intelligence. Thus they are the actuals, not the casuals, as it must be clear to the commonest intelligence that a thing cannot move without an antecedent motor. If we do not really know what matter is, it cannot be expected we should explain what mind and sensation are, or the interconnection of the organism and the intelligence. Practically matter is an existing fact, so is sensation, so also intelligence, and so freedom of will.

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[1] When this was said the phonograph and microphone were unknown. Oxygen, hydrogen, nitrogen, and atmospheric air, had not been liquefied, nor had electricity been used for lighting purposes.

Probably between the genesis of man and his ultimate, as elsewhere reasoned, free will is man's fact. Over his ultimate he has no more control than he had over his genesis—*cæteris paribus* we are bound to conclude the end of all men is the same, the difference being in the intervals of its consummation. Assuming there is a life beyond this life (*vide supra*, p. 147), it is a continuing existence, a probation where the spiritual entity, be it what it may, receives its final finish through unlimited culture. The capacity or *potence of man is* "*the capability of culture.*" It is also clear, unless the *Ego* cognizes in its individual consciousness an objective fact, to the *Ego* it has no existence, summing Berkeley's idea—very much that of the Fichte of history—that objective existence is only cognizable by its existence in the consciousness of the *Ego*, or of other *Egos*, or in a consciousness which comprises all *Egos* and all objectivity. Excepting an allusion to Fichte, interpreted in a manner peculiar to the lecturer, we have, in conclusion, commonplaces and assumptions. Fichte has been before interpreted by Carlyle. Construing Fichte by the light of Uberbweg, instead of the maniac he is inferred to be, we find a man of powerful intellect and genius, one who did not dwell in assumptions and material hypotheses, but who was able to present a reasoned conclusion for the opinions he entertained.

The office of wisdom is not alone to present the *whys*, but the reason for the *whys*, so far as our finite capacities permit. It is quite possible to ask questions which no science can solve; but it is not philosophical to assume, because the question cannot be answered, that the *unknown* has a material basis, that subjectivity is non-existing as a principle, and that objectivity is alone the moulder and worker-out of our facts.

The imperceptible becomes the objective by the action of the unperceived *e. g.* water is composed of two imperceptible gases thrust into combination by the action of an imperceptible force. If this occurs in that with which all are familiar, can we deny that intelligence has within itself a similar power? The gases, by chemical affinities and by man's intelligence, are converted to his purposes, if man in his finite aptitude, can seize and control them, what then are we to conceive of infinitude which not only controls but creates and fashions? Is it because a few isolations in nature are mastered that the assumption is to be made that all which is beyond scientific and physical analysis or the anticipations of physical science, are merely emanations from matter? We may dream our dream. We know the viewless can become the objective. We know amalgamated poisons become innocuous substances and life-supporters, but we do not know the *why of the fact*, we know that such is the working economy of nature. We know sensation can excite intellect, we know both exist, and that in their amalgamation we have man, but we know nothing of the chain-links which bind the mind and the organism. We know the organism is resolvable into gases, but we do not know how these gases become objective. We know there are animate forms, but we do not know the cause of their animation. We know there are forces, but we do not know the whence of them. If then, these things which are known cannot be interpreted by the known, *is the unknown to be denied because the known cannot comprehend it, when even the known cannot itself be comprehended.*

The comment is addressed rather to the substance of the lecture than to the words, for which see *Times*' report.

Whatever the origin of matter, whether it be as Kant suggests, the objective presentment of a thought, or whether as the physicists assert, matter eternally existing, is a serious and difficult problem; a wide gulf stretching between the definitions. Both to our comprehensions appear to be existing principles. There is the subjective and the objective, can both be eternal? The solution of the problem then becomes a question of probabilities.

Science determines there are sixty-five elemental substances. In the practical acceptation of the word there is but one eternity; to which of these elements is the priority to be awarded? We cannot suppose a synchronous rush of the whole into existence unless we suppose all are the incidents of a primary. *Supposing* it were so, the data would still be insufficient; the forces must have places, without them the gaseous elements would have lain in strata, there would have been neither cohesion nor combination. All we know of phenomena expresses their homogeneity, hence we admit there can be but one eternal cause—or matter—as the governing principle. The choice is thus limited to matter, or spirit, *i.e.* intelligence. If matter be this principle or cause, intellect and force are but its emanations. If intelligence be the cause there is the difficulty of presenting it objectively. We have seen the imperceptible, becomes the objective by a process imperceptible. The gases have existed since the world was; yet little more than one hundred years have elapsed since Priestley discovered oxygen. Intelligence was the worker by which the substance was assured. This enforces the conviction that the intelligence which directed the processes or method of nature is at the least as boundless as her phenomena; thus the imponderable, the intangible, and the unperceived constitute our realities, because they are always subsisting and are universal. No science has practically demonstrated the origin of Intelligence, we only know through its subjecting energy, that it exists. The organised is not eternal or is eternal only in its vitality; so worlds may fade and be rehabilitated. Synthesis dealing with the perfected magnitude sees but littles infinitely repeated. Analysis finds the littles, and the magnitude falls when the mass is disintegrated into the littles. The philosopher sees in his magnitude its qualities and quantities. The physicist finds the quantities but the qualities evade him. The philosopher sees in the cause the effect. The physicist finds an endless succession of effects which he pronounces to be "a precession of causes," a finity in succession to a finity, which he deems to be the finality, hence the dogma of the eternity of matter. In perception there is no infinite. By conception, in the unseen is found Infinitude, infinitely prolonged; can we not say this is Eternity?

Besides matter and mind there is heat and its conditions, undulations, or vibrations? An undulation assumes the shaking of a something through the material of which the undulation must proceed;[1] this is force action. Can force claim the eternal honour? Without heat there were no force—force is said to engender heat: let us consider. Is it possible force can engender that without which it never could have existed? Heat conditioned is heat, light, electricity, &c. (in correlation), and these conditions become the sensible facts of the principle. Science shows light is resolvable into qualities, heat rays, light rays, and chemical rays, *i.e.* the calorific, luminiferous, and actinic. If light has weight it has substance. If the ether presents resistance it has substance. It does not follow because the ether presents resistance there is no rehabilitating power in nature as maintaining and sustaining; the friction is the expression of work by which the energy is stored. It is impossible to suppose the possibility that the agencies instituted to carry on the work should *wreck* the universe. This would be indeed reducing the *technics* of infinitude to the *technics* of the finite. The technics of man cannot constitute an eternity. The technics of Infinity constitute Eternity in their purposeness.

Heat is said to have no weight yet it is a measurable quantity. If it be an undulation in particles, of what particles? "The clash of the molecules" displays motion; motion is heat whether as an undulation, or as a principle. Endless difficulties are presented:

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[1] "The idea of a resisting medium in space astronomers consider to be confirmed by the motions of Euke's comet, which cannot be explained without such a hypothesis. Besides, *a residual phenomenon*, as J. Herschel expresses it, "adds consistence to the theory;" from this cause, it is said, Euke's comet loses less than $\frac{1}{1000}$th of its velocity in thirty-three years (ten revolutions). If a resisting medium be existing the movements of the solar system cannot go on for ever. The moment such a fluid is ascertained to exist the eternity of the movements of the planets becomes as impossible as perpetual motion on the earth." (Whewell, *B. T.*, p. 200.)

a force as resulting from heat is the initial fact, from which motion follows, but it cannot be said motion engendered that which produced it. Heat may be called the function of nature, in which sense it would precede all structure, however incorporated in Nature. Phenomena thus would be an ingeneration of heat, as the means by which the subjective could be objectively shown.

Without heat there would be no-thing, no-thing we know as phenomena. We cannot say phenomena generate that by which they exist; it would be like saying the young of creatures generated their mother. The first existing, persisting and universal principle we arrive at in phenomena *is heat*, by its modification we have gas, liquid, and solid, latent or sensible (static or dynamic) heat exists in all things, its presence is everywhere. Without heat there were no life, without life there were no consciousness, without consciousness there were neither substance nor intellect for man as he is constituted. Can we then say that heat is the first principle, and that from it all things came? It cannot be demonstrated that heat generates anything, although we know nothing can be generated without heat. We cannot suppose it generated intellect, for intellect, as far as we know, exists without heat, and by its interaction on the particles of the conducting medium makes apparent the principle heat. Intellect is as imponderable, imperceptible, and impalpable as heat. Tyndall says: "When we ponder it is the brain that thinks." Is it not rather the imponderable principle which stirs within us which thinks, and whose movements become what we term consciousness, thus linking the perceived with the unperceived. Unless we are to suppose this brain-matter is self-active, there must be a mover, and what is that? Thought is a constituent principle, or effect of intellect, it follows that if molecular action originates thought it originates intellect! The brain is composed of organic substances and pulsates with the organism; traced backwards we find the substances of which it is composed are floating mists, but never without heat. Heat and cold, we are taught, are relative conditions of the same fact. We have the flaming hydrogen of the sun's envelope, and we have the cold of space through which the heat given off by the burning hydrogen radiates, without influencing it and yet after its passage on striking an object the radiation from the surface becomes sensible as heat, and by a subsequent act (radiation from the work) the atmosphere is warmed.

Given the condition and qualities, the facts of heat are always the same.[1] There is a regulating principle; but if heat be the eternal something, by what is it regulated? To regulate requires intelligent action. This brings us to demand, What is intelligence? The material presentment has been examined, and has proved fallacious as an eternal principle. From matter we get inertia. A molecule to move requires a mover; thus an antecedent to its existing self. Intellect is that which guides, governs, invents, controls, and directs.

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[1] When all the relations of the sun and the planets are considered, and systems connecting systems and cycles of suns, and the passage of the sun's heat through

Heat and matter constitute an organised form; with vitality (another principle), the form is animate and conscious; with mind, intelligent. We then arrive at heat, life, consciousness, and mind, four imperceptible, imponderable, intangible, universal somethings, and we have substance through which their actions are manifested. We then also arrive at an existing living intellect, conscious, as manifested by acts of will. Where is our beyond? A set of syllogisms would prove the logical certainty of the position, a set of x's and y's the mathematical certainty, but neither would be a positively demonstrated proof of the problem—we have a probable possible, but no tangible fact.

We then fall back on the original proposition (c. 4, p. 109) of this work, viz. perception, which knows material phenomena, and conception, which knows intelligent abstraction. Without heat nothing exists, without intelligence there is no control. Can we not say that heat generates all things of perception; that conception makes manifest intellect which controls and interprets perceptive effects? Intelligence (*sui generis*) is uninfluenced by heat, but heat becomes manifest through its action. We can then say intelligence by its action generates heat. And what is generation?—in what does it consist? Minute particles consolidated on themselves (centres of heat, or force—heat foci, force foci), closed circles, the unclosing or closing of which is the development of force; a lap, an overlap, or an underlap; a lap or light band closing on another, darkness ensues; undulations closing on undulations, no sound is heard. Thus, we may say,

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the ether of space and the atmosphere, neither of which are heated thereby, as an hypothesis it might be suggested that the so-called heat of the sun exists in its magnetic phase, as being more in consonance with known or supposed facts.

If heat be the primordial substance, then, all things being composed of it, the magnetism of particle on particle would be established, the magnetic power of the Sun would influence the magnetic particles of the Earth, and so substance would react on substance, and by this influence the air and all we know as substance would be acted upon, and we could say that motion results from the inherent magnetism of substance acting on substance. Undulations and the static and dynamic powers of heat would receive an explanation more in consonance with observed facts than that of the radiations of heat from a distance of 92,000,000 of miles, and vibrations numbered by millions of millions acting on the eye in a second of time. In this view all heavenly bodies would be magnets, and resulting motions magnetic influences due to sun energy, not to sun heat, unless by correlation.

intellect generates heat; heat force, or motion; force compels phenomena. We then have phenomena as a consolidated objective effect, and conscious intellect. Thus intellect as a principle becomes manifested as intellect a condition. Objective phenomena then become but the reflection of intelligent thought. We began with the principle intellect, we end with conditional intellect, and when the conditional slides back into the principle the cycle is complete. Think it as we may, be overcome as we may by expressions of sublimity, whether excited by the contemplation of terrestrial phenomena with all its grandeur of change, or whether we direct our gaze on the stellar phenomena—those glistening points—suns and worlds, we arrive at conscious intellect enthroned in the midst, crowning with an ever presence the conceptive energy, through and out of which all terrestrial and celestial wonders have become manifested. By the facts of our reflective reason we discern this, and when we extend our thought to the grand continuity, a for ever continuing intelligent consciousness, the confession is forced from us *that this* is GOD,[1] the Intelligent principle, the Intelligible fact of all things; the Cause, the Controller, the Substance, the Principle and Essence of things as we know them or can think them.

CHAP. III.

HEAT—HEAT A PRINCIPLE CONDITIONED.

BY the material hypothesis matter in its atoms is indestructible and eternal, and Earth, "the great mother" from whose womb all things are said to proceed, in generating herself generates all else. What is the fact? Earth is an aggregation of particles derived from her environment, cohering through the life energy inherent in them, and may be likened to a germ presenting form and diversity, to us an immensity, and yet but a particle in a universe of particles. The principles which govern her infinitesimal units, govern her. She exists in her particles, impulsed by imponderable principles, beyond which there is direction and control, as exhibited in the purposeness of order, a homogeneous conglomerate of life units. Earth is the matrix, the great reservoir, a passive receptacle wherein all substances are condensed, the life-bearer, the bed of generation, not the generator. When we are told principles are material emanations, and that intelligence is dependent on molecular motion, we analyze our facts, and find but the fallible in the finite. Our teachers, as Newton expressed of himself,[1] are like boys searching the shores of an unfathomable ocean, their findings infinitesimals, waifs which have broken loose, abounding in the wide-spread immensity before them. The facts they have collected may be classified as practical results, but their predicated history may be utterly false, mere hypothetical assumptions, which, as Kekule truly says, "are gradually raised into articles of faith, and those who sin against them are persecuted" (*vide* note 4, p. 1). To propound a new deduction from a principle, or to attack a deduction presumed to be established, excites a dogmatic resistance. Locke wittily defined the position.[2] Yet we are said to live in an era of scientific liberty, but it is a liberty, so far as our professors are concerned, which must run in a given groove. There is no finality in science; at its best it is but a postulate of probabilities. The hostility of the Church to the extension of knowledge arose from the fear of innovation, and was but an acknowledgment of the weakness of her position. We have, in another form, the perpetuation of this dogmatism; it is that which makes science so thorny a road to the neophyte. If we look into its annals, lengthy indeed is its list of martyrs. We have Pythagoras, Anaxagoras, Democritus, Epicurus, Galileo, Harvey, Peysonnell and Buckland, and others. The theories they propounded were met by persecution, by derision, or contempt, and yet their hypotheses are established as scientific results. Elliotson and Reichenbach, men of ability, propounded theories which may become high philosophies in the science to come. Gall and Spurzheim showed a constructive theory of mind. Were these men charlatans? Yes! as all men are who reprove the ages by presenting systems in advance of established crudities. In this day Crookes investigated an important, although tabooed subject, and for courageously announcing his conclusions, derived from observation and experiment, he was met, not by disproof, but by invective and abuse, because his announcement disappointed the preconceived ideas of our savans. Few men can afford to be original or to express ignorance. Newton, Leibnitz, La Place, Du Bois Reymond, and Virchow, above the pettiness of their times, admitted the insignificance of "the known to the sum of the unknown." Helmholtz, with a true scientific acumen, says: "All that science can achieve is the understanding of an action of natural and moral forces, and each student must be content to rejoice in new discoveries as new victories of mind over reluctant matter."

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[1] The word GOD in the Saxon finds its synonym in that of *good*. In every other language the expression is of a Lord or ruler. In Jehovah the signification is somewhat extended, but never reaches the Saxon conception as a spiritual ideal. In the mystical Eloihim there may be such an expression.

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[1] Newton, in the preface to the *Principia*, says: "The whole difficulty of philosophy seems to me to lie in investigating the forces of nature from the phenomena of motion." "Many things lead me to suspect that everything depends upon certain forces, in virtue of which the particles of bodies, through forces not yet understood, are either impelled together so as to cohere in regular figures, or are repelled and recede from one another."

[2] He asks, "Who will be prevailed with to disrobe himself at once of all his old opinions and pretences to knowledge and learning which with hard study he hath been all his time labouring for and turning himself out stark naked in quest afresh of new notions? All the arguments which can be raised will be as little able to prevail as the wind did with the traveller to part with his cloak, which he held only the faster (B. iv, c. 20, 11).

The propounders of theories which admit of a materialistic construction are hailed as instructors, whilst those who present such as might elevate science are innovators and charlatans. The effort now-a-days is made to eradicate the idea of God as a Creator or as a Provident and Intelligent being. On being probed, this hostility is found in an antagonism directed against systems of theologies, because theologians repressed free thought in Kosmic ideas. Liberty gained can only be preserved by its judicious exercise; when it degenerates, as in the rebound it too frequently does, into licence, we clank the same fetters. Men in all ages are much the same; they clamour for their fetish, and get it, newly named, newly dressed, and newly ceremonialized. The men of these days deny that principle of being which the ancients symbolized and respected, and are not so lucky as the Alexandrians, who found their ideal in the mother of a God, but the God, as Creator, offered by the savans, is a mass of moulded matter.[1] In the sea of materialism, where every floating speck assumes gigantic proportions, there are many divers, although but few secure the pearl. A handful of slime is hailed as the nucleus of a microcosm to come, and as a solution of the mystery of the Kosmos. This mysterious stuff turns out to be "a vehicle all strewn with the maddest Waterloo crackers, exploding distractively and destructively wheresoever the mystified passenger stands or sits" (*Carlyle*).

When we uplift the curtain of sense, that veil of mystery, and look into its beyond, we find everywhere a fundamental principle working and unifying, which leads to the conception of a material ultimate intelligently directed, substance correlated with substance and force with force.[2] John Scotus would have said, "It was the auspices of the reinstitution of things" and the return to a primordial conservatism. We search the facts of sense and might live in sense, but, with intelligence as an interpreter, through the symbolical we reach the real. Tertullian wisely said, "Time is the ally of truth, and wise men believe nothing but what is certain." If the certain, *i.e.* the unchanging and universal is only to be accepted, in matter we cannot find it. In conscious intelligence we have this certainty—it leaps the gulf and satisfies the human understanding in its demand for continuity. To demand the proof of a fact present in the minds of all men, is only to dull its appreciation by an "iridescent cloud of words" which they are incompetent to satisfy. Consciousness may be synchronous with continuity, but certainly is not a consequent of molecular displacement. Heat exists in all objects and forms, whether they be gaseous, liquid, or solid, and yet it has no solid consistency. The limestone rock (as lime) in parting with its heat falls at our feet an impalpable dust, and by an admixture with water again becomes a rock. The iron by the agency of heat will flow in a stream, or become clothed with the impenetrability of the diamond. Nature has her depository of stores, but the artificer is always among them—the unit of heat, the power

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[1] Hume says, "It is remarkable that men have a natural tendency to rise from idolatry to theism and from theism to idolatry" (*Nat. Hist. Rel.*, p. 54).

[2] The imponderability of heat is shown in the test of heating a pound of mercury and a pound of water in opposite balances to the same degree of temperature, and

whether it be reduced or increased the substances remain in equipoise, although thirty times the heat will enter or leave the water than it would the mercury. More delicate tests present the same facts, as a sunbeam falling on a delicate balance produces no depressing effect on the scale. Hence it is said heat has no forward motor inertia or momentum. Rumford made water boil by the friction of a blunt borer rubbing against a mass of metal immersed in water. Davy melted ice, by the friction of two portions, in a temperature of 32° F. Proofs of the materiality of heat are adduced; it is radiated through the most perfect vacuum obtainable more readily than through air, the radiation being in all directions and without impediment from crossing rays; on the condensation of a mass heat becomes immediately sensible, as if then squeezed out, as in hammering cold iron, and in mixing bodies which occupy less space when chemically united. These instances appear to prove that whatever heat be, it is something specific. The ignition of gunpowder presents such facts; if it were only the motion of the mass, whence comes the great expansion? If the power be in the particle, it is a something specific and a substance, although imponderable. Some suppose "that the phenomena of heat are produced by an exceedingly subtle fluid pervading the whole universe, softening or melting or gasifying bodies," and by its properties seeking the "widest and most equable diffusion." Its quantity may be measured, and its qualities inferred. Heat a wire, it is lengthened; heat water in a full vessel, it flows over; all substances, with few exceptions, gain bulk in proportion to the increase of temperature. Handle ice with one hand, and then thrust it into cold spring water, and the water feels absolutely warm; take the other hand from heated water, and put it in the same spring water, and the sensation is that of a chilling cold. This experiment shows the heat is a specific something which specifically acts upon sensation. Thus it would seem that both heat and sensation have positive and negative qualities. Throughout phenomena we have the same relativeness—heat and cold, the ponderable and imponderable—force and inertia, the positive and negative, the static and dynamic. The whole exemplifies the process of the finite and in results has relation to animal organization.

of life is always present, always accomplishing results, now consolidating masses, now shrinking into itself, and withdrawing its cohesive powers spreads the rocks abroad as dust, the sport of every passing wind.

The pertinacity with which scientists endeavour to solve all the infinitesimal facts by *a given*, shows the insufficiency of their reliance upon perceptive results. These givens and logic, what sins they cover, easily expressed and obstinately insisted upon.[1] Given A generates B, the union of A and B the other letters of the alphabet, Z as the final sensuous perception, expresses a phenomenon of the universe. Each letter is related to the other and all to each, A is the expression of itself, and therefore Intellect, equal in quantity and quality to the whole. Thus given A is intellect and B heat; then B expresses the phenomenon of the universe, as derived from A and concentrated in Z. Arranged in the mathematical formula, we have as grand an exposition of the universe, subjectively and objectively, as the disquisitions of a celebrated mathematician, who expresses as definite masses of matter that which is viewless and weightless, at the least to man! Yet science is "observation and experiment" interpreted "by trained common sense!" The French dictum is, the scientific theory cannot be considered complete until it is so clear that it can be explained to the first man you meet in the street. But all is quite in accord with the hypotheses of science, which call the active and working principles of nature, because imponderable and unperceived, molecular vibrations, which can attain to an importance only through the forces which excite them! If undulations be the all where are we to seek the Kosmic unity? It is like the minute philosopher who consulting his microscope finds stupendous energies stored in a drop of water, and then conceives gigantic organisms reflected in minimums, hundreds of which would find a field of exercise on the head of a pin. A glance into the laboratories of Physicist and Chemist fills us with wonder, because there we find simulations of the methods of nature, which after all, present but a feeble reflex of that greater laboratory the universe, where Intelligence, with a power equal to compass every result, presides.

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[1] "Mathematics can tell us nothing beyond the problems she specifically undertakes, she will carry them to their limit and there she stops; upon the great region beyond she is imperturbedly silent" (Spottiswoode). She cannot tell whether matter be continuous or discrete in its structure, nor of its origin, nor of its creation, nor of its annihilation, nor whether there be limits or not in time and space. "Conterminous with space and coeval in time is the kingdom of mathematics; within this range her domain is supreme" (*ib*). "She does not . . contribute elements of fact; . . but she sifts and regulates them and proclaims the laws to which they must conform if those elements are to issue in precise results" (*ib*).

We have the machinist and manipulator with whom gravitation is but the adjusting balance, and all the intricacies of phenomena but the offshoots of thought. Thus nature in the unison of her harmony is enthroned in divinity, of which the universe is the embodiment, finding a reality in the ILLIMITABLE ALL—*that which was* and *that which is*—the sole Eternity, INTELLIGENCE.

We are conscious of our own being, and by sensory perception are instructed in a world of facts, but withal there is an inner cry of where is reality? Every where there is mystery, this mystery every mind tries to solve but never arrives at a solution; with a thousand instructors we meet only sophisms, we have the expression of a symbol but never the thing itself. What we groan under is not the tyranny of thought but the dogmatism of assumptions. Matter we are sometimes told *may be* an outgrowth of spirit, but what is spirit? If it be not the thinking fact of our own existence man has from all time wasted his moments in chase of a will o' the wisp. We glean our own shallows, catch minnows and proclaim them to be trout.

In the view of the science of the time matter and secondary causes are the sole objects of contemplation, as though the presentments of the one and the successions of the other were not effects originating from a primordial impulse. The very admission of such a possibility as a secondary cause, by implication, confesses a first cause as an antecedent fact.[1]

"Matter at rest would never by itself cease to be at rest," how then is the hypothesis of Tyndall to be verified (vide *Belfast Address*)? Science traces matter backwards until a kosmical incandescent vapour is arrived at, and we are gravely told "not alone the mechanism of the human body but that of the human mind itself—emotion, intellect, will, and all their phenomena—were once latent in a fiery cloud" (Tyndall).[2] This, to use the words of Carlyle, is "diluted insanity." Science has found some of the methods of nature; and as though the findings of science were the all of nature; by a perversion of reason the method is pronounced to be the cause.

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[1] "Knowledge is distinct from opinion, from feeling, and from all other modes of subjective impression, still the limits of knowledge are at all times expanding and the boundaries of the known and the unknown are never rigid or permanently fixed. That which in time past or present has belonged to one category, may in the future belong to the other. Our ignorance consists partly in the ignorance of actual facts and partly also in ignorance of the possible range of ascertainable fact. If we could lay down beforehand precise limits of possible knowledge, the problem of physical science would already be half solved. But the question to which the scientific explorer has often to address himself is not merely whether he is able to solve this or that problem but whether he can so far unravel the tangled threads of the matter with which he has to deal as to weave them into a definite problem at all" (Spottiswoode, *Dub.*, 1878).

[2] "I have always kept apart the speculative and the proved. Before Virchow had laid down his canons I had reduced them to practice!" (Tyndall, *XIX Cent.*, 1878, p. 507).

The truest idea of matter is attained in the expression of force.[1] Force in its static state becomes objective, as solids, fluids, and gases, resolvable each into the other; thus atoms or molecules are really the ultimate particles of energy, which when reduced into the possible minimum, are resolved into the primordial, becoming imponderable and imperceptible, and after undergoing the same rounds of energy again become objective. In such a view we find a consistent method in nature. The tendency to inertia is the expression of the static state of force, the same energy required to originate motion is required to arrest it,[2] and force and motion become heat. Probably it never will be known how matter was initiated or what is its ultimate structure; therefore hypothesis is reared against hypothesis; according to Hume's postulate the most probable hypothesis should be accepted. All the facts of nature tend to an assurance that matter, in the objective form, is the effect of a principle yet undetermined by science, *through which forces are displayed*—the plastic substance which nature first created and then moulded to its purposes; the same amount of force is found to affect the same amount of matter; can we say force is the incident of matter? if not, does it not follow that matter is the incident of force? The only evidence we acquire of the continual existence or eternity of matter is by the continual amount of force displayed. "When we weigh matter our evidence is the force of attraction, again our evidence of force is the matter it acts upon." We cannot conceive "a force without an antecedent force." Grove says he cannot conceive the opposite "without calling for the interposition of creative power any more than (he) I can conceive the sudden appearance of a mass of matter come from nowhere and formed from nothing" (*Correlation of Forces*, p. 265). "Causation is the will, Creation the act of God" *(ib.* 271).

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[1] Forces change the nature of substances. The correlate of the force which changes gas into liquid in one point of space and liquid into gas in another, equal volumes disappearing and re-appearing, to the inexperienced appears like the passage of a fluid through solid wires (*Cor. Phy. For.*, p. 250).

[2] The phenomenal effects of gravitation and inertia are motion and resistance to motion. Thus a meteor rotating round the earth, supposing there to be no resisting medium, so long as the rotation continued the motion would be the exponent of the force impelling it. Supposing a resisting medium to exist, if this motion be arrested and taken up by the medium, be the mode what it may, then if the meteor approach the earth and fall on it, the motion of the meteor is stopped, but it is taken up by the earth causing a vibration through its mass; part of the motion also reappears as heat both in the earth and in the meteor, and part in the change of the earth's position consequent on its increase of gravity, gravitation being a mode of force probably identical with that of pressure, or motion, *i.e.* weight (*vide* 251, Grove, *Cor. Sci.*).

If from a piece of granite and its surrounding air all the elements contained in an egg, and a grain of wheat can be collected (Pritchard), the inorganic is co-ordinated with the organic, leading to the idea that the primordial principle is identical in each, the differentiation being due to conditioned force. If in the germ cell the forces be existing which develop "into a man or an oak" it is easy to conceive, that as the germs or cells multiply in a geometric ratio, that the forces multiply with them, and that the expenditure as growth (work) is continually replenished, the static continually becoming the dynamic, expressed in animation. In the germ or organization vital force[1] is the active agent; in the inorganic it probably acts by the process of catalysis.[2]

The greatest Kosmic idea of the age, philosophically pursued, is the correlation of forces, inadequately treated by the professors, or we should hear less of matter as causation, and of potences which exist but in "scientific imagination." In force is to be found the method by which nature acts, explained as a *unity of changes.* Force is everywhere, no substance coheres without its manifestation. In the universal concentration of power, as heat presenting motion, we find the order and arrangement we know as phenomena.[3] "Of absolute rest nature gives no evidence;" on a change other changes supervene, a change of temperature is a change in the equilibrium of other bodies, these move in their turn, counteraction producing re-action, and as regards the mass, unity of action. A body in motion would continue so for ever in the same direction and with the same velocity, unless impeded by some other body or force than that by which it was initiated. Function is impeded motion. If the motion of a body were suddenly arrested there would be the same amount of heat developed as there would be were the motion carried through a great number of points. Heat becomes motion and motion becomes heat. The friction of water produces heat, and through its action was found, that science terms "the equivalence of heat."[1] The general proposition of science is that motion is the initial force; motion is a resulting effect, heat is never present but motion is produced, how the factor of motion becomes the mode of motion is not explained. The proposition of Joule that heat is converted into work (motion) proves heat causes motion, and motion through friction makes heat apparent, the heat through motion is reconverted into work, and work through motion is reconverted into heat. The principle of the correlation of forces proves that there is an initiating principle and the forces are conditions of it; also that each force can assume the place of another and in the conditional phase each can initiate the other. When out of heat, as a condition, the other forces are evolved the ultimate result is heat. Supposing the initiatory principle of phenomena be heat, the round of the conditional forces may be gone through, yet in all cases heat eventuates, and shows that heat, light, electricity, chemical affinity, magnetism and motion, are but the conditions of a principle diversified in action and application; this Grove doubts.[2] The forces must be the collective energies of something; in regarding any of the forces as initiatory, or regarding them as a collective fact, we do not get at the initiatory principle. We do not find electricity or any of the conditions revert into themselves as electricity into electricity or magnetism into magnetism, or motion into motion,[3] but into some other of the conditions, but all end in the expression of heat. Heat, in our ignorance of the ultimate, appears to be the origin and end of all material phenomena; in principle it is universal.[1] The circle commencing in heat, as a principle, completes the circle by reversion into the principle. Maxwell says, "We have heat in the unit of a measurable quantity, but must not treat it as a substance because it can be transformed into work. We must not rank it as a substance until we have further evidence of its nature" (*Theory of Heat*, p. 7). Newton appeared to think "that heat consisted in the internal motion of bodies," but Maxwell prefers to use the term "heat generated." The general idea of heat is represented by temperature.[2] In old time heat was considered as an imponderable substance, but now it is said the word heat is not "a scientific term;" and when used to express a measurable quantity[3] it is not free from ambiguity, because associated with words expressive of quantity; *we are not to say hot if we would be scientific*, but are to use the more scientific word, temperature. The word hot as the abstract expression of sensation as experienced on contact with things is abolished. In a word, that which was supposed to be a material something is *translated into a sense*, as in the case of pain, &c. The only name we have for this sensation "is the sensation of heat." However absurd the abstract idea of heat is pronounced to be, I am hot, or I am cold, shows the state of the sense although it does not express it in degrees. In scientific experiments it may be necessary to express the degrees with exactness, but for all general

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[1] Grove says "muscular force, animal and vegetable heat, &c., will probably be found to have the same correlation as inorganic substances." This may be, for it only points to the method of nature; but this is far from saying that muscular action is not the result of vital force.

[2] Catalysis or chemical action is induced by the presence of a foreign body, as when a slip of platinum is introduced between oxygen and hydrogen in a receiver more or less rapid combination will ensue. No new force is yielded, it only determines the chemical action, but the force when developed may be converted into the voltaic form, *e.g.* a tub containing oxygen and another tub hydrogen, the bases of both being connected by water or other electrolyte, introduce down each a connected slip of platinum, both ends of which are immersed in the electrolyte, a voltaic connection is formed, and electricity, heat, light, magnetism and motion may be produced (*Cor. of Phy. Forces*, p. 228, 229).

[3] We may invariably resolve heat into motion, "and view it as a mechanically repulsive force, a force antagonistic to the attractions of cohesion or aggregation tending to move the particles of all bodies or to separate them from each other" (*Cor. of Forces*, p. 43).

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[1] In Joule's experiments, "an apparatus formed of floats or paddles of brass or iron is made to rotate in a bulk of water or mercury, the power which gives rise to this rotation is a weight raised like a clock weight to a certain height; this acting during its fall on a spindle and pully communicates motion to the paddle wheel, the water or mercury serving as a friction medium and calarometer, the heat being measured by a delicate thermometer. The results obtained are considered to prove that a fall of 772 lbs. one foot raises the temperature of one lb. of water one degree Fahr. (In his experiments he tabulated to the 1000th part of a degree Fahr.) (*Cor. Phy. Sci.*, p. 35). In science this is called foot pounds.

[2] Grove appears to be of opinion that there is no distinct direction or principle in respect of forces. He says, "The true expression of the fact is that each mode of force is capable of producing others, and that none of them can be produced but by some other as an anterior force; then any view which regards either of them as abstractedly the efficient cause of all the rest is erroneous" (*Cor. Phy. For.*, p. 250).

[3] "Force in its limited sense may be defined as that which produces or resists motion" (Grove), and is not the expression of the effect but of that which produces it. After the discovery by Oersted of electro-magnetism, and before that of magnetico-electricity by Faraday, electricity and magnetism, high authorities supposed, stood in the relation of cause and effect, but now with equal truth it may be said either is the cause of the other. "Where magnets existed without any apparent electrical currents, hypothetical currents were supposed," "but now," with equal truth, electrical currents may be referred to hypothetical magnetical lines; if, there-

fore, electricity cause magnetism and magnetism cause electricity, then electricity causes electricity, which becomes *a reductio ad absurdam* of the doctrine" (Grove, *Correlation of Forces*). The absurdity may be rid of by supposing they are conditions of a principle,—*heat*. Of heat as a principle, science admits nothing; the conditions only are met with. Without heat there is nothing; we cannot say the same of the other conditions, but if heat be accepted as the primordial unit, the more static its state the more solid its substance, by the display of the conditions the primordial unit becomes active. Magnetism and electricity thus are acting conditions of the static principle. Whether we speak of heat as static or latent, it is the same, for it is immediately active when conditions are apt; then arise disruptions, disintegrations and changes, through the resulting effects of the conditions, yet heat would be the antecedent, or cause.

[1] Newton, after speaking of the change of water into vapour, says, "And among such various and strange transmutations why may not nature change bodies into light and light into bodies?"

[2] Maxwell (*Heat*). "The idea of temperature is the property of a body considered with reference to the power of heating other bodies, and the idea of heat as a measurable quantity which may be transferred from hotter to colder bodies."

[3] Max Müller says, "Till lately caloric was a term in constant use, and it was supposed to express some real matter. . . That idea is now exploded, and heat is understood to be the result of *molecular and etherial vibration*. All matter is now supposed to be immersed in a highly elastic medium and that medium has received the name of *Ether*. No doubt this is a great advance; yet what is this Ether, which everybody now speaks of as a substance? heat, light, electricity, sound, being only so many different modifications of it. *Ether* is a myth, a quality changed

purposes nature is the best thermometer. Heat may not be a substance but it acts as one. Heat apparently is in opposition to gravitation, but gravitation is probably a correlated force, if so the opposition is only apparent. Tyndall, with his expressive genius, seeks its correlation as his originating thought, as from men and their writings he had learned "that the notion of gravity being an outstanding force, entirely incontrovertible, was prevalent among them" (1875, *Constitution of Heat*).[1] Grove, in the modest expression of his facts, says, "Gravitation being but a subjective idea its relations to other modes of force seems to me identical with that of pressure or motion. Thus, when arrested motion produces heat, it matters not whether the motion has been produced by a falling body, *i.e.* by gravitation, or a body projected by an explosion, &c., the heat will be the same, provided the mass and the velocity at the time of the arrest be the same. In no other sense can I conceive a relation between gravitation and the other forces" (*Cor. For.*, p. 321, ed. 1862).[2]

The simplicity of description has scant place in modern science. The general idea of the law of fluids is of a pressure equal in all

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into a substance, an abstraction, useful no doubt for the purposes of physical speculation, but intended rather to mark the present horizon of our knowledge, than to represent anything which we can grasp, either with our senses, or our reason. As long as it is used in that sense, as an Algebraic X, as an unknown quantity, it can do no harm, as little as to speak of the dawn as Erinys, or of Heaven as Zeus. The mischief begins when language forgets itself, and when we mistake the word for the thing, the quality for the substance, the *nomen* for the *numen*" (*Sc. Lan.*, v. i, p. 663, 7th ed.).

[1] The law of gravity as applied to the sun is that *the attraction* varies *inversely* as the square of the distance, *i.e.* decreases as the square increases. Distances being as 1, 2, 3, the power is as 1, 4, 9, so increasing in a geometrical ratio. Kepler's law of mutual attraction was precedent to the discovery of the theory of gravitation, but is really an incident of it. Simply stated, "every particle of matter in the universe attracts every other in accordance with the law of the inverse square of the distance." Newton suggests on the hypothesis of an elastic medium in space, increasing in elasticity as we proceed from dense bodies outwards, that this "causes the gravity of such dense bodies towards each other—every body endeavouring to go from the denser parts of the medium to the rarer" (Newton's queries). Le Sage's idea, as illustrated by Prevost, was, all space is occupied by currents of matter, moving perpetually in straight lines in all directions with vast velocities, penetrating all bodies. When two bodies are near each other they intercept the current which would flow in the intermediate space if they were not there, and thus receive a tendency towards each other from the pressure of the currents on their farther sides. It was supposed the line of the moon's *apsides* (*i. e.* her greatest and least distances from earth) moved with twice the velocity which gravitation would induce, and thus was subversive of the theory. The idea arose from an error in the calculation. Buffon asserted that force could only vary in accordance with the law of the inverse square. Gravity is a quality, an emanation, and emanations all obey this law. This position was attacked by Clairvault (vide *controversy*, Whewell, *B.T.*, p. 228). Herschel has shown that double stars which revolve around each other in ellipses obey the law of the inverse square.

[2] Mesotti had before mathematically treated the identity of gravity with cohesive attraction

directions. Maxwell tells us "that a fluid is a body the contiguous parts of which act on one another with a pressure which is perpendicular to the interface which separates the parts," and we have an isosceles triangle to prove his description.

Heat, or whatever else it may be, in its vibrating fact, becomes diffused by conduction, radiation, and convection. "Substances which admit of the radiation of heat through them without becoming hot . . are . . Diathermanous; those which do not admit the passage of heat through them without becoming hot are Athermanous." The radiation of heat is called thermal, to distinguish it from the conduction of electricity and the radiation of light. Heat travels in rays like those of light. When the radiation is stopped a body becomes heated, when it becomes luminous the rays are scattered on the surface. As a general rule bodies expand when heated; iodide of silver is an exception (*Fizeau*). When they become cool they contract; water, bismuth, and a few other substances are exceptions.

Maxwell says physicists do not assent to the proposition that the heat communicated to ice is still in existence as heat.[1] The term latent heat is that form of heat communicated to a substance without raising the temperature.[2] The term has a scientific acknowledgment in the phrase "the latent heat of fusion." Müller, of Berlin, demonstrated that steam at an ordinary pressure being sent into a solution of salt (*chloride of sodium*, on which it has no chemical action), the temperature is always higher—one-third (*Nat.*, v. 16, p. 72). Grove says latent heat is a mere mental conception, and ought only to be received on the ground of absolute necessity.[3]

[1] Black's discovery of *the latent heat* of liquefaction and of vaporisation, *i.e.* the latent heat of liquids and of vapours, was made whilst a professor in Glasgow. These discoveries and his researches into the differences of mild and caustic alkalis were the foundations of his fame. Dewar (*Dissociation of modern ideas of chemical action*), says, "Black may be regarded as the father of modern chemistry. He availed himself of the queries of Sir Isaac Newton, who, although he published nothing directly on chemical science, nevertheless in those queries expressed chemical opinions. Black's great discoveries were connected with the transformation of bodies when they either liquefied or became gaseous, and with the great doctrine of latent heat.

[2] The consequences of the property of latent heat are important. "Each part in succession must have a proper degree of heat applied to it. If it were otherwise thaw and evaporation would be instantaneous; at the first touch of warmth, all the snow which lies on the roofs of our houses would descend like a water spout into the streets; all that which rests on the ground would rush like an inundation into the water courses. The hut of the Esquimaux would vanish like a house in a pantomime; the icy floor of the river would be gone without giving any warning to the skater or the traveller; and when in heating our water we reached the boiling point, the whole fluid would flash into steam, and dissipate itself in the atmosphere or settle in dew on the neighbouring objects" (Whewell, *B. T.*, p. 92).

[3] Water at 172° mixed with an equal weight of ice 32°, the whole will be reduced to 32°; "the ice changing its condition from the solid to the liquid state abstracts from the liquid as much heat as it requires to change it into a liquid state, which is rendered

He seems to be of opinion that the abstracted heat is used in work. This phenomenon "has generally been considered as strongly in favour of that view, which regards heat as a principle, or matter, or . . . . as a substantive entity, and not as a motion or affection of ordinary matter." Heat produces a repulsive action between masses.[1]

If, as Grove and Clausius say, the heat is *expended* in the work, whence is the re-energy? The squeezing and refrigerating processes used in rendering oxygen, nitrogen, and air liquid,[2] show work, but not that the heat was expended; for immediately the tension was loosed the substances resumed their former volumes. If the heat had been converted into work it was reconverted into heat. If viewed in the light of the correlation of forces, it is a persisting fact, used and re-used, and yet existing.[3]

Science says, "Heat is a form of energy, because it may be generated by work." This is something like saying it is present and not present. If there were not *heat innate* there would be no work to display it as an effect. Heat is the fact of motion, and light a force, but whatever the force exhibited it is due to calorific action; light is said to have weight (2000 *lbs. to the square mile*). The same chain of reasoning would show heat to have weight, through pressure caused by expansion. If gas acts as a spring, it does so through the energy of heat. There are continually new theories and views in relation to energy, all of which appear identical with Helmholtz's theory of the conservation of force. In the ultimate idea motion is the effect of friction, and can only be excited by the presence of heat, and, however brief the interval, it must exist between the antecedent and the effect. When a mechanical

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latent or remains associated with itself so long as it remains liquid, but of which heat no evidence can be afforded by any microscopic test" (*Cor. of Phy. Forces*, p. 49).

[1] Fresnel's and Baden Powell's experiments showed that 1st, mobile bodies heated in an exhausted receiver sensibly repelled each other; 2nd, Newton's rings change their breadth and position when the glasses between which they appear are heated and that the glasses repelled each other. Clausius says, "latent heat is not only as its name imports hidden from our perceptions, but has actually no existence," it has been converted into work. Yet in another place he says it is the *vis viva* of molecular motions.

[2] At the beginning of the century it was regarded as proved that air was a substance which differed from a fluid in having stored in it in some way a certain quantity of heat. In 1805 Dalton stated he had no doubt that the permanent gases were liquefiable bodies. Twenty years were required before Faraday liquefied any gas. It is commonly supposed that a fluid and a fluid only boiled. Dewar, in an experiment, showed that ice in ether presents the fact as shown by the continual process of ebullition, though the temperature of the block of ice was below that of the polar regions.

[3] Black showed the quantity of heat to raise a temperature depends not only on the mass but on the quality of the mass. Irvine called it capacity for heat, Gadolin specific heat. Capacity is the number of units of heat which raises the temperature of a body 1° Fahr.

mixture, gunpowder, and a coil of steel, are enclosed in a cylinder and fired by electricity, the steel is fused and twisted, and resembles the skeleton of some meteoric iron (*Nat.*, vol. 15, p. 561). The motion is due not to the electricity, it could be arranged to pass through the powder without igniting it, but to the spark which excited the motion and fused the material. In all problems of force heat is a resulting fact ; surely we should say the latent became sensible, or rather the static became the dynamic fact.[1]

If heat be energy expressed as work, and the amount of heat in the world is always the same, how can there be "wasted heat" or "degraded energy ?"

Practically (notwithstanding the necessities of physics) there appears to be no distinction between potential and kinetic energy. Shot is propelled, and reaches an elevation, the energy is exhausted or counteracted by the friction of its passage (*i. e.* its work) ; this is called kinetic. The shot suspended in air is motionless, by attraction it falls from its elevation and reaches the earth with the velocity of its propulsion ; this is potential energy (as Helmholtz says), expressed in the rebound of a bent spring. Heat is both a principle and conditioned, and these conditions, as expressed in the correlation of forces, are its innate facts. If there be an innate principle in mind, as now admitted, there probably is in physical facts. Nature is always awaiting her opportunity, or, as Goethe says, "knows no pause in unceasing movement and production, and has attached a curse to standing still." It is the fitness which makes all things consistent. A change in the principle of heat would throw the world of phenomena into confusion or cause its disruption. The slightest change in the constituents of the atmosphere would render it unfit to support life, as we know it. Not a star comes to its appointed place at the calculated time but proves the exactness of law. If there be a common principle in the organic, surely there is the same in the inorganic. The rule once displayed in phenomena is always continuing, the variations are but resulting conditions. We assume there is a time intervening in the results of motion. May it not be that this intervening time has relations only with our perceptions, and that results ensue without distinctions of time ? In principle it is so ; but we reckon by the relations of effects. Chop a thing as we may, the poles are always existing. This shows polarization is an innate principle, not a mere consequence of shifting particles, but *incident in the thing.*

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[1] That Helmholtz calls the sum of tensions, Thomson calls statical energy, Rankin potential energy. Maxwell says this is a felicitous term. Tyndall seems to consider "specific heat" and "capacity for heat" in effect the same, for he says, "Without harm we may continue to use the terms now we know the true nature of the actions covered by them" (*Heat*, 145). Young used the term energy to express the quantity of work. Joule has shown that energy is convertible.

All bodies consist of minute parts.[1] Whether as molecules or heat foci, if the latter it would be innately constituted as the unit of force, or of life, or of construction. "The heat accomplishes what may be termed *interior work;* it performs work within the body heated by forcing its particles to take up new positions" (Tyndall, *Heat*).[2]

In science the distinction between fact and theory is continually intruding. Grand generalisations are not to be esteemed as final results, but only as the highest exposition which induction, aided by facts of observation and experiment, has arrived at.[3] Science is the knowledge of the development and amplification of littles. All the ages have been rife with theories; they slumber as indistinct hypotheses, and suddenly assume the proportions of digested facts, but do not assume this position until opinion is ripe for their reception. Thus astronomy, if history is to be credited, made great strides in the early eras of the world. At a time when Europe had not emerged from barbarism; and even when civilization had made immense strides, astronomy was the merest surmise; yet in these ages the sun disappeared beneath the line of the circle (horizon), and created no remark. The earth was a flat plane to which the sun, in a circling flight, paid his daily adoration; the stars were fixtures in a moving mirror of glass.[1] The initiations of discovery are the stepstones of knowledge. These initiations, when based on true principles, are zealously tested, and it is indeed rare that the conclusions drawn remain a mere dream.

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[1] Grove says he does not use the word molecules in the sense of the atomist, or insist that matter consists of indivisible particles or atoms, but "as contradistinguishing the action of indefinitely minute physical elements of matter from that of masses having a sensible magnitude, in the same way as lines or points may be used in an abstract sense" (*Cor. Phy. Forces*).

[2] Heat is not the clash of the winds; it is not the quivering of the flame, nor the rising of the theometric column, nor the ebullition of water, nor the motion which animates steam when it rushes from the boiler in which it has been compressed. All these are mechanical motions, into which motions of heat may be converted, but heat itself is molecular motion, it is an oscillation of ultimate particles" (Tyndall).

Maxwell says, "All bodies consist of a finite number of small particles called molecules, each of which consists of a definite quantity of matter, the same for the same substance, and its mode of combination the same. It may consist of several distinct portions held together by chemical bonds, and may be set into any kind of relative motion, and so long as they do not sever it is a molecule, all molecules are in a state of continual action, but the hotter the body, the more violent their agitation. In solids they never get beyond a very small distance from their original position. In fluids there are no limits to the excursions of the molecules, they traverse but a small distance before their path is disturbed by an encounter with other molecules and then they are pushed into new regions. The actual phenomena of diffusion both in liquids and gases furnish the strongest evidence that these bodies consist of molecules in a state of continual agitation." (What cause is there for this agitation but heat?)

In continuation, he says, "the action between them goes on for a finite time, during which the centres of the molecules first approach each other and then separate." This he calls "the free path of the molecule." What is all this but saying that the force overcomes the inertia, and that the weight and the inertia act together, and that the new motion is due to the elasticity of the masses, an interaction of force in force, or, as he phrases it, "in an encounter between two molecules we know that since the force of the impact acts between the two bodies, the motion of the centre of gravity of the two molecules remains the same after the encounter as it was before. We also know by the principle of the conservation of energy that the velocity of each molecule relatively to the centre of gravity remains the same in magnitude and only changes in direction" (Maxwell, *Theory of Heat*).

[3] Oersted said, "The laws of nature are the thoughts of God." The solution of any natural law is rethinking the primæval thought. Plato said, "Nature was but the art of God; His artificial machinery." Socrates said, "Let it suffice you to see these works: adore the gods for these and think by them they show themselves to us; you cannot behold their form" (Xenophon). Although there are no writings of Pythagoras extant, from those of his disciples we learn, that upon his

Schelling says, "Philosophy advances not so much by the answers given to different problems as by stating new problems and by asking new questions." Tait thinks no theory should be formed unless it is based on experiment. Huxley, in his observations on "paper philosophy," seems to have the same idea, yet science is indebted to many a haphazard suggestion. Even the settled convictions of science, derived from a long series of observations, are sometimes overthrown by an accidental discovery. When all is said for science which can be said, it is but the finite perception of an infinite plan. Theories formed by reasonings without experiment have led to the establishment of law; as Helmholtz's "conservation of force," which he worked out in ignorance of Joule's theory. The Kosmic hypotheses of Kant and Laplace are also in example.[2] Hippocrates said, "It appears to me that what we call the principles of heat are im-

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system of the heavens astronomy is founded, a revival after two thousand years of oblivion. He was the first who used the word kosmos (ornament and order) to express the order which reigns in the universe and the world (Philolaus Böckh). Galileo, Leonardo da Vinci, Hook, and Cassini suggested the law of gravitation before Newton had published his *Principia* (vide *Lucretius*, part 2, c. 1.), and no doubt even if Newton had not lived, the period being ripe, the law of gravitation would have been discovered before the conclusion of his century. The merit of the discovery is not the less his due, although it may be said that but for Galileo and Kepler he had never mastered his problem; after all it hung on the question of the true measurement of a meridian.

[1] Pascal said of space "that its centre is everywhere and its circumference nowhere." This may be said of the universe. Pythagoras assumed the earth was a sphere floating in space. Thales calculated eclipses.

[2] *Nebular hypothesis.* The sun revolved on his axis surrounded by an atmosphere which by heat was extended far beyond the orbits of the planets, they having as yet no existence. Contraction occurred through cooling, the rapidity of the rotary motion increased, and an exterior zone of vapour or ring became detached by centrifugal force, this breaking, coalesced into a mass and revolved around the sun and retain-

mortal. It knows all, sees all, hears all, perceives all both in the past, the present, and the future. At the time when all was in confusion the greater part of this principle rose to the circumference of the universe. It is this the ancients have called the ether." In its nakedness we have the modern theory of undulation as wave vibration.

The old view of science looked on heat as an imponderable substance, indestructible, unchangeable in quantity, and an essential and fundamental principle of matter, and when it disappeared it was said to be latent. It is found in all conditions of substance, in chemical processes in constant quantity, and that whether the combustion be slow or rapid. The French physicists demonstrated heat to be a substance constant in quantity; its relation to mechanical work had not been estimated. It can be produced by the friction of solids, or liquids, by the compression of gases, and by the impact of imperfect elastic bodies, but the friction and the impact of inelastic bodies are said to be "processes in which mechanical work is destroyed." Joule measured the amount of work destroyed by friction, determined the quantity of heat produced, and established a definite relation between the two, known to physicists as the unit of heat. He inferred, "unless there could be always found the same amount of heat from the same amount of work, whatever were the bodies made to rub against each other, it would be in vain to seek for such a thing as the conservation of energy." "If work and heat be equivalents, in any sense you must always get the same amount of heat from the same amount of work," whatever the engine employed. He proved that the equivalents exist, and fixed 772 foot pounds as a unit of heat, *i.e.* one pound of water, falling 772 feet, finds its equivalent in a degree of Fahrenheit. Colding held, "Force is imperishable and immortal," and "when it seems to vanish it undergoes a transformation, and reappears in a new form, but of the original amount, as an active force."

ing its form presented a ring as that of Saturn. Portions of the sun's atmosphere detaching at successive distances formed planets in a state of vapour, each having motion, a planet would be produced having satellites and rings, partaking of the original rotation of the sun, necessarily the motion of the rotation of the planets would be in the same direction. This idea La Place proposed as a conjecture. The Kosmic theory of Kant, worked out independently, is similar. Whewell asks, "How came the sun with his atmosphere, materials, motions, constitutions and consequences? How came the parent vapour to be capable of cohesion, separation, contraction, solidification? How came the laws of its motion, attraction, repulsion, condensation, to be so fixed as to lead to a harmonious and beautiful system?" and, he continues, "how, amongst many more things, came that previous state to exist? We get from luminosity to luminosity, tenuity to tenuity, at length, as La Place says, We arrive at a nebulosity so diffuse that its existence could be scarcely suspected" (Whewell, *B T.*, pp. 181, 187).

Carnot (1824) believed heat to be material, and suggested a perfectly reversible engine in which the heat expended in work should revert back to heat. His idea of the indestructibility of heat was controverted by Thomson, but ingeniously proved by Clerk Maxwell. Helmholtz says Carnot hit upon the true theory; his law was, "only when heat passes from a warmer to a colder body, and even then, only partially, can it be converted into mechanical work. Mayer, Colding, and Joule, laid hold of the same thought."[1]

"Gas allowed to expand with a moderate velocity becomes cooled, and this work is said to be performed at the expense of heat, but if allowed to *come into an exhausted receiver does not cool; if individual parts become cooled, others become warm, the temperature becomes equalised, and is the same as it was before the expansion of the gas.*" It is obvious, the expansion taking place in air, that the heat of the gas passes into surrounding objects. When it takes place in a vacuum there are no absorbing particles, and the heat is preserved, *i.e.* remains uniform. The example shows that by the mere expansion none of the heat is lost. Helmholtz says, "*These facts no longer permit us to regard heat as a substance, for its quantity is not unchangeable; it can be produced anew from its* vis viva *of the motion destroyed.* It can be destroyed and then produces motion. We must rather conclude that heat is itself a motion—*an internal invisible motion of the smallest elementary particles of matter.*" It appears to me the conclusion arrived at by Helmholtz is exactly opposite to that which should be drawn from his argument, which proves, not that heat is a mere motion or vibration, but an actual and subsisting principle. It shows, not that the quantity is changeable, but that it is always the same. Motion may cease and be reproduced from the *vis viva* of the motion destroyed. What is this but the condensation of heat, a retirement into its ultimate particle: if it be not always existing from whence is it reproduced? Motion may cease and be reproduced, showing *the quality* is always continuing. This motion is not a reaction of itself, but the result of heat, in its condition latent or sensible. Admitting heat to be "an

[1] Boscovitch maintained the ultimate elements of matter are indivisible points without extension, surrounded by spheres of force alternating in respect of distance: the sphere nearest the points is one of repulsion, the intensity increasing as the point is approached, beyond the point of repulsion it slides into attraction. There is a sphere in which the influence exists and is energised, a sphere of repulsion again follows, and so on until a perceptible distance is reached in which gravitation alone prevails. If a body be so constituted with attraction in the ascendant it will be a solid. If the points are repellant it will be gaseous, but if neither attraction nor repulsion are in the ascendent, it will be liquid. In all bodies there are modifications, change one sphere of attraction for another, although a solid is still the result, it will be a new body, even if there be no chemical change. The difficulty of the system is the indivisible point without extension.

internal invisible motion of the smallest elemental particles of matter," this goes far to prove that heat and matter are the same, that matter is a condensation of heat exhibited in the smallest elementary particles, and that the motion within the particles is due to the action of the primordial unit. The *principle*, heat, appears to be inherent, as shown by its action in a vacuum, its conditional fact alone varying; at all events this proves permanence as to quality. If then, there be permanence of quality, there would be permanence as to quantity, and in heat we most probably have, so far as matter is concerned, *the ultimate fact of the facts*.[1]

Kronig, Clausius, and Maxwell have developed the undulation hypothesis. "What appeared to the earlier physicists to be the constant quantity of heat,[2] is nothing more than the whole motive power of the motion of heat, which remains constant so long as it is not transformed into other forms of work, *or results afresh from them*" (Helmholtz). When we reflect that the power of the particles is the power of the mass, and that gases are really solids in expansion, it seems difficult to understand how there can be any distinction between the action of particles, whether in gas or in a solid. The real distinction being that the interstices are larger in gases than in solids, and thus the action may be more readily remarked. The constitution of the thing being the same, that which is true of a gas is true of a solid, conditions alone are changed. If, as Helmholtz says, "the heat passes into the smallest particles," and if it be "nothing more than the whole motive power of the motion of heat, the conclusion must be that heat is both existing and persisting, *i.e.* innate, *and that in this unit of force we have the primordial unit of matter*.[3] We have the statements of the old and the new theories. The old idea was that heat was an imponderable substance called caloric; the new idea is that it is an undulation, or, as it has been expressed, "a molecular and ethereal vibration," not a substance at all. For practical purposes it may be necessary to make the distinction (even then the treatment is as of an existing thing), but when we pass the facts in review and inquire, *What is heat?* we conclude it to be a principle in nature, varied as conditions require variation, and most probably the relativeness of each of them to the other has significance in the sensible or latent fact. It is pertinent *that no two sums of heat can be added to make a sum of the several quantities*, *e.g.* two bodies; temperature—one of 100°, the other of 40° combined present a temperature of 120°, not 140°, or take 60° and 40°, the result is 50°, not 100°. Substances combine in proportions by affinities. A ray of light will obliterate a ray of light, sound will obliterate sound, the powers of electricity may be added to electricity and increase the intensity; it is not so with heat; we have but an equalization. A power, whatever it may be called, that is always present and always adjusting itself, must be considered inherent, a principle, *if it be not the ultimate principle, both of matter and force.* No touch but indicates its presence, whether of the most gentle character, or whether of a force bearing all before it. All we know of forces are modifications of heat; all that science really knows of heat is its effects. We may speak dogmatically, and assign to it different names; whether it presents itself as a vibration, or as a real substance, it is a persistence; it is locked up in the ice, and rampant in combustion; not a wind blows, not a natural phenomenon occurs, but we can trace it to heat. If, instead of the atom, or the molecule, or the smallest *elementary particles* of Thomson or of Helmholtz, we suppose the unit of heat is the *unit of vitality*, force points closed or unclosed, miniature vortices, that the power is within the particle, and that both quantity and quality are merely its developments—this would at the least bring us nearer to the comprehension of ultimates. Heat is talked of as a measure of work—beautiful, ingenious, and painstaking are the various theories—and although the fact heat, is exemplified in work, it shows, (life-like) a principle which is for ever waiting to make its hidden resources apparent.[1]

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[1] "Energy of position" and "energy of motion" are transformations of heat. "Actual energy is exemplified in the *vis viva* of moving bodies—in heat, electric currents, &c., potential energy in a bent spring or in a body suspended a given distance above the earth and acted on by gravity" (Helmholtz).

The present explanation of science is that heat is not a substance but an undulation. "Like light it is a peculiar shivering motion, of the ultimate particles of bodies," "Thus in collision and friction, according to the manner of viewing the subject, the motion of the mass of the body, apparently lost, is converted into the motions of the ultimate particles of the body; and conversely, when the mechanical force is generated by heat, the motion of the ultimate particles is converted into the motion of the mass" (*ib.*). The nature of this internal motion "can only be asserted with any degree of probability in the case of gases; their particles probably cross each other in rectilinear paths in all directions, striking against another particle, or against the sides of the vessel, they are reflected in another direction (*ib.*).

[2] In the 18th century the word caloric was used and it came "to connote not merely heat, but heat as an indestructible, imponderable fluid." And at length "to imply the recognised existence of something material, though probably of a more subtle nature than the newly discovered gases" (Max Müller, *Sci. of Lang*).

[3] This view expanded would present the idea that elemental substances are facts

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of one substance differentiated; hence would arise a correlation in character similar to that of the forces. Eventually it may be found that substance is but the objective presentment of the forces.

[1] Thomson's theory of pressure applied to ice and the consequent liquefaction of part of it. Bertholet's investigation on the nature of ozone (condensed oxygen) shows "it is a body in which heat is absorbed in its formation. Its activity in com-

On collating the old and the new theories of heat, they do not appear to be so diametrically opposed as they are assumed to be. The old calorific idea presents the principle, the new idea shows the *working* effect, which really is but the difference between specific and latent heat, or the dynamic and static. So far as material facts are concerned a *heat hypothesis* would more fully and more sensibly account for phenomena than the *matter hypothesis.* The latter could not exist without the former, and the former would present difficulties unless it can be shown that heat in some form becomes solidified. By the action of heat, we know all solids can be rendered imperceptible. Reasoning inversely, do we arrive at the idea that the primordial unit of terrestrial things is that of heat? Huggins' spectroscopic olefiant gas lines of the comet may show the initiatory process of heat consolidation.

The proposition that heat is the primordial ultimate out of which matter arose, worked out in a series of syllogisms, presents an à priori *logical proof, (if it does no more).*

Wherever terrestrial phenomena are presented, heat is presented, latent, or sensible.

All matters of perception can be resolved into, or be determined by heat.

Therefore heat is a principle (or the unit) of all terrestrial phenomena.

Intelligence is not a terrestrial phenomena (immaterial).

Intelligence cannot be resolved into, or be determined by heat.

Therefore intelligence is independent of heat.

That which generates a principle is its antecedent.

Intelligence generates heat,by which all things else are generated.[1]

Therefore, as from intelligence heat is generated, intelligence is the first principle.

The conclusions of the syllogisms complete the problem:

Heat is a principle, or the unit, of all terrestrial phenomena.

Intelligence is independent of heat.

Therefore, as from intelligence heat can be generated, intelligence is the first principle.

The mode of expressing the scientific idea of heat confounds the thing with the form in which it is expressed. Davy said,

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bination is probably due to the heat being set free" (*Nat.*, v, 16, p. 71). Müller's (of Berlin) experiment of forcing chloride of sodium into steam is also in point.

[1] Intelligence generates heat by inducing the molecular changes of the brain substances by its impulsion. If it be insisted on that the brain matter generates intelligence all argument must cease. *All is matter, or no matter. So advanced is thought,* the mystery of the world is little more than the mystery of a cooked dumpling, yet inquisitive minds will inquire by what means the apples got in (vide *Sartor Resartus*).

"The immediate cause of heat is motion." Tyndall considers "heat as a mode of motion;" Séguin, that "the amount of work done by an expanded heated body is the equivalent of the heat *it loses;*" Mayer, "the amount of heat produced in compressing a gas, or any other body, is the equivalent of the work spent in compressing it;" Helmholtz, "the law asserts that the quantity of force which can be brought into action in the whole of nature is unchangeable." Mayer showed his fact by the recuperative power of the vital function. Joule and Colding consider that when force appears to vanish it undergoes transformations, again to reappear as active energies.

Tait says Séguin's calculations are wrong on one side of truth, and Mayer's on the other, but Mayer's substance (air) has been proved by Joule to be capable of giving an exact result. Séguin has the credit "of seeing *that if heat be not matter* some of it must disappear in the working," that Mayer has undeservedly the credit of discovering the dynamic theory of heat and of the conservation of energy, and that too little credit has been given to Joule.

Joule and Mayer appear simultaneously and independently to have thought out the principle of the conservation of energy; Helmholtz and Tyndall give the priority of the discovery to Mayer; Tait considers Joule to be entitled to the honour.[1]

It will be gathered that in the view of science heat is but the undulations or vibrations of particles of matter, heat being thus regarded as an incident instead of the substance. Many talented men hesitate to accept this dictum, even whilst admitting there are difficulties of explanation, unless the hypothesis be used.

In 1839–1841 Dr. Joule described in a publication electro-magnetic engines. In 1840 he announced as a law "that the effects of equal quantities of transmitted electricity are proportioned to the resistance overcome by the current." Whatever was the shape, thickness, and character of the metal, it was proportioned to the square of the quantity of transmitted electricity. In 1843 he read a paper wherein he said, "The mechanical power in turning an electrical machine is converted into heat evolved by the passage of the currents of induction through its coils, and on the other hand that the motive power of the electro-magnetic engine is obtained at the expense of the heat due to the chemical reaction of the battery which worked it."

In 1840 Dr. Mayer, in Java, observed that venous blood had a singularly bright colour, and concluded it was due to the temperature, less oxidation being required in tropical than in temperate latitudes. He held that in all cases in perfect combustion fuel yields an equal amount of heat; hence that the living organism was incapable of generating heat out of nothing, but yet is capable of generating heat outside itself, therefore the heat generated within and without the body is to be regarded as "the true calorific effect" of matter oxidized in the body, and must stand in fixed relation to the work done. If this were not so the oxidation would vary; hence "a fixed relation exists between heat and work," and "is a postulate of the physiological theory of combustion." In 1842 he published his theory in *Liebig's Annalen.* If these theories be identical in principle, then Dr. Joule appears to have the priority, but if only his 1843 publication is to be taken into account, Dr. Mayer.

A plate of glass presents no inequality of surface which can be probed by any point, however minute, yet light will pass through its mass. Light is said to be waves transmitted through the ether. Cooke (*New Chemistry*) says he does not agree with those who consider the wave theory of light as established, yet admits its value as explaining unknown phenomena. And remarks:

> "The theory requires a combination of qualities in the ether of space which I find it difficult to believe are actually realised—for instance, the rapidity with which the wave motion is transmitted depends—other things being equal—on the elasticity of the medium. Assuming the two media have the same density, then the elasticity is proportioned to the squares of the velocities with which the wave travels." "Sound travels about 11,000 feet in a second, light 192,000 miles, about a million times greater. If the density of the ether be as great as that of the atmosphere (one third of a grain to a cubic inch), its elasticity, or resisting power, would be a million million times that of the air, and the pressure, instead of being 15 lbs. to the square inch, as of the atmosphere, would represent that of a cubic mile of granite rock." "This," he says, "is an absurdity, for it is assumed that the ether pervades the densest solids, as water does a sponge, and could not be confined." "The ether is a medium so thin that the earth in the motions of its orbit suffers imperceptible retardation;[1] yet it is endowed with an elasticity proportioned to its density a million times greater than that of the air" (*ib.*).

If the ether is governed by the law of fluids the pressure would be equal every way, and would only be controlled by itself. Where are the enormous rending forces, as stated by physicists, to come from, if they be not contained in their *foci?*—forces sufficient to penetrate the pores of iron and the harder platinum, the sullen lead and crystalline surfaces of glass.

Whether there be waves of ether or not, there is in light something which has definite dimensions. It "is difficult to think clearly on the subject without the wave theory, and though it may be a phantom of our scientific dreaming, these magnitudes must be dimensions of something." White light is produced by all the rays of colour acting synchronously on the eye, the number of waves in an inch and oscillations in a second have their count in numbers which no perceptive power can comprehend.[2]

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[1] La Place calculated that each day measured by the stars is so precisely of the same length that it is impossible that a difference of the $\frac{1}{100}$ of a second should have been attained from the earliest ages to the present time, because in the rotation of the earth on its axis there is nothing which operates to retard its speed "she spinning sleeps," whatever may be the fact as to the orbital motion.

[2] How large heat units, force units, or light units are (if there be such things), no one knows. Only on the hypothesis of the wave theory of light can any proportion for colour waves be assumed. We are told it is a simple calculation *a mere question* of arithmetic. The velocity of light is 192,000 miles in a second, 12,165,120,000 inches, 39,000 waves of red light make up an inch. Multiply the number of inches by the waves of vibration we have 474,439,680,000,000. These waves enter the eye in a single second of time. The violet has still a greater number of waves, taking 57,500 to fill an inch. The other colours of the spectrum rise

Each of the seven colours in the white light is represented by five ranges of figures, and they result from the assumptions of that which constitutes the sum of "eternal matter." Substitute the ultimate particle of heat, as the unit of life, and these difficulties vanish. In the ether probably resides the force by which the light rays may be split and conditioned. Nature exists in an eternal change, decay, and recuperation, and is not the mere play-ground of the molecules but is heat, in its phase of force interlacing thing with thing. The law of the magnitudes is the law of the littles. Microscopic shells have built mountains, and we see all the formula of life where a drop of water constitutes a world.

Art has its triumph even in littles. Nobert, the German optician, has ruled 224,000 lines in the space of an inch, "and regularly makes plates with bands from 11,000 to 112,000 lines in an inch," for microscopic tests.[1] The lines have been photographed, and when magnified and reflected on the screen "the lines are distinctly visible" (Cooke). These ruled bands gave the means by which the waves of light were measured. In astronomical calculations the light is assumed to pass through space with the calculated velocity. On entering the prism the rays are dismembered, and the components assume different velocities.

> "If the materials of the glass were perfectly homogeneous throughout it is impossible to conceive, on the wave theory of light, . . how a mere difference in the size of the luminous rays should determine this unequal velocity, with the accompanying difference of refrangibility." "Some think there is not an absolute continuity in its matter (glass), but that there are interstices so small that it requires the tenuity of a ray of light to pierce them."

We make our conceptions the measure of the resources of nature. If we suppose the substances of the glass to be banded forces, the light also being force, and that the impact splits the white light into its component forces, it is easy to imagine that the conflict of the units of force causes the phenomena. That there are distinct forces in light is shown by the possibility of splitting it into colours, these colours representing particular conditions. The unequal velocities show the disparity of the

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gradually in pitch from red to violet (*Tyndall on Heat.*) Averages may be assumed, but averages, in our ignorance of the working facts of nature, may be utterly untrue. The number of waves are calculations in averages. Tyndall derived his idea by observing tints of colour scattered laterally when they clustered in the forms of actinic clouds.

[1] F. W. Potter, of Hill Street, Finsbury:—In the notice in the *Times* of the Tin Plate and Wire Workers' Exhibition at the Crystal Palace he makes mention of a piece of wire gauze exhibited which contains 8,100 holes in one square inch. In the same case is exhibited another roll of gauze with 14,400 holes per square inch, a piece of which 16 inches square contains 3,686,400 holes, or more than the population of London.

forces in action in the inability they exhibit to overcome equally the resistance. The ether is probably an homogeneous substance through which the light passes, as through a compact substance.[1]

Those who are curious as to the estimate of numbers in relation to forces will be thoroughly gratified by consulting Cooke's *New Chemistry* (pp. 24-32), where he comments upon these minute enormities of the wave theory. He says that to every square inch of surface we have the pressure of a cubic mile of granite. If the molecule[2] is a real existence this weight is also. If that we term matter is the objective presentment of heat, or force, a simple unlap would solve the whole question. Beginning with *a given,* all things are possible of proof. Cooke says the molecule is no longer a metaphysical abstraction, but a reality, and the idea of infinite hardness, absolute rigidity, and other incredible assumptions, is no longer connected with them. "The *New Chemist's* molecules are definite masses of matter, exceedingly small, but still not immeasurable; they are points of application to which he traces the action of the forces with which he has to deal." The molecules are to the physicists real magnitudes, "which on the one side are no further removed from our ordinary experience than are the magnitudes of astronomers on the other." We now arrive at a *definite something* (vide *Thomson's Calculation*, p. 39, note 1). "An object having a diameter of an 80,000th of an inch is perhaps the smallest of which the microscope could give any well-defined representation; and it is improbable that one of the 120,000th of an inch could be singly discerned with the highest powers at our command" (*Spottiswoode*). To insist upon the existence of matter *per se* in the face of such calculations is a solemn absurdity; perception could not reach, nor could conception realize them. The atom is not to be confounded with the molecule. "To the physicist the molecule is a definite unit, to the chemist the atom stands in the place of the molecule." "To

[1] Castile soap, glycerine, and water will form into a soap bubble of the utmost tenuity, on which prismatic colours will occur in bands which reflected through a monochromatic light and passed through a lens on to a screen well illustrates Tyndall's theory. He says, "Whenever the difference of path brings the crests of the waves of one set of waves over the troughs of the second set we obtain this wonderful result—that the union of two beams of light produces darkness," *i.e.* when the hollow of the curve of a wave is filled by that of another wave the undulation is blotted out or obliterated. Helmholtz says it is the same with the wave of sound.

[2] Avogadro's law declares all gases contain, under like conditions of temperature and pressure, the same number of molecules in the same volume, and if we rely upon the calculations of Thomson, "the number is one hundred thousand million, million millions," "or the formula 10^{23} to a cubic inch." Barometer 30 inches, thermometer 32° F., *i.e.* when in the condition of perfect gas. Yet, "in the state of perfect gas it is assumed the molecules are so widely separated that they exert no action on each other."

me . . . . they are just as much real magnitudes as the planets; or, to use the words of Thomson, pieces of measurable dimensions, with shape, motion, and law of action, intelligible subjects of scientific investigation" (Cooke). The unit of life and the molecule may be identical for the purposes of scientific investigation, but no hypothesis can make them other than they are.[1]

If the savans have truly reported, their facts exist amid a tumult of forces. These crushing weights are everywhere balanced, and from the uproar and war of the molecules uniform order results. Faraday showed when the ether was subjected to magnetic action, on passing through it a copper plate, "it was like cutting cheese, although there was nothing visible."[2] Tyndall says, "The ambiguity of the word force has for a long time been creeping on us." To convert water into steam, the force required is equivalent to 822,600 foot pounds, *i.e.* a power which would raise a mass four tons in weight to the height of 100 feet. Whence comes this force? If effected by heat the force resides in the heat as an integral part of the mass. The force thus becomes the energy of the thing itself—latent energy excited to sensibility—thus the expansion of its unit would account for the phenomenon.[3] Heat is condensed as vapour by the combination of oxygen and hydrogen particles—oxygen from the air, hydrogen from the flame—and from this combustion, from this interaction of the various gaseous substances is consummated all combinations resulting in solids. The hydrogen, is it a constituent of the flames and of the unseen combustions, or has it its base in carbon? We inhale oxygen and nitrogen (air). The oxygen deposits the nitrogen and unites with the carbon of the organism, and is expired as a new combination (bioxide of carbon). Is it not possible the carbon is a resultant of heat, everywhere present and everywhere producing? This heated carbon, what is it? A residuum, an unused energy, or the reversion to a primordial, again to be used, again to be re-formed? Carbon in combination with oxygen is exhaled by creatures and plants—matter united in chemical affinity. The flaky soot (carbon), it meets us everywhere. We assume that we have facts, have we the *real facts?* The riddle we have to solve is that *ultimate reality out of which all facts have evolved.*

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[1] According to Cooke, if the undulatory theory be more than an hypothesis, we have enormity of weight. On the molecular theory we have the substantial things of the world reduced to nothing; and yet these nothings, according to the material hypotheses, are the generators of all we know, think, or feel. A proper outcome for an absurdity is to breed an absurdity. A ray of light travelling 192,000 miles in a second, a swiftness of motion which would encircle the earth upwards of 7125 times, has to cleave its way through the ether and to overcome a continually recurring resistance of myriads of millions of tons. Such are the exigencies due to *the exactness* of science in the relativeness of things.

[2] In modern physics space is regarded not as a vacuum in which bodies are placed, but rather as a *plenum* in which matter is co-extensive; replace matter by heat as the universal principle, and how many difficulties are smoothed away?

[3] In the force of steam, viewing the minute globules as a collection of voltaic cells whose collective energies display these amazing powers, a possible solution may be gained. It has been shown an electric flame can be evolved in steam in its rush through an aperture. This goes far to lead to the conclusion that the force is innate in the microscopic globules. The theory of correlation shows force in principle is individualized, transmuted through its conditions. De la Rue's battery of 10,000 cells almost affords the evidence that a voltaic discharge, apparently continuous, may be an intermittent phenomenon. The telephone has shown that sound is an electrical manifestation, or acts electrically, whilst the microphone shows that its intensity is due to intermittent currents. Carrying these principles into the workings of nature, all things appear to be derivable from heat through the intermittent action of its conditions. Intermittent, because it is the unity of minute particles which swell into uncontrollable power. The uniformity of nature results from an infinite complexity, underlying which is an infinite diversity, the resultant of agglomerated littles; but there is no evidence, when intervals and areas are indefinitely diminished, to show this fact, however applicable it may be to definite intervals and definite areas.

CHAP. IV.

VITALITY.—CAUSATION.—CELL THEORY.—SPONTANEITY.

Vitality eludes analysis. The electrician can disperse the diamond; the chemist can resolve the calc spar into its components, lime and carbonic acid; but no effort can reconstruct it, the vital cohesion passed in the disintegration. Analysis has probed the protoplasm, proving it to be composed of the same elements as water, air, and carbon. Protoplasm is protogenous; "protein has never been determined with exactness," albumen being the nearest approach to it. Generally, the protoplasm is affected by electricity, and is liable to coagulation at between 40° and 50° C. What is life?—molecular action with endless transmigrations and permutations, only differing from the inorganic in the disposition of the particles! If vitality be but an emanation from matter, to be again resolved into matter, when will its work be done? Huxley says, "All work implies waste, and results directly or indirectly in the waste of the protoplasm." Yet science regards matter as a wasteless thing, or "the conservation of matter has no meaning." He continues: "this waste of the protoplasm is repaired by nutriment; whatever is consumed, be it animal, fish, fowl, or vegetable, the protoplasm is consumed with it" (*Lav Ser.*). Given the protoplasm to be the engine of vitality, it does not prove it to be vitality. If the protoplasm were vitality, and had been consumed or wasted, the principle had disappeared before it, as nutriment came into action. Nutriment sustains, but vitality is the worker. Surely, originating and sustaining are not the same?

Is there waste? The inorganic becomes the organic by the interfusion of vitality. Particles are used and exuded, inert substances revivified, become active agents, and so it is through the untiring rushings of the never-ceasing vortex. A force is disbanded to be again rendered active. Dead particles, where are they? Nature is but a continuous cycle of changes. The inorganic becomes the organic, now inert, now active, everywhere vital energy, sensible or latent.[1]

"The existence of the matter of life depends on the pre-existence of certain compounds." What is this pre-existence but an aggregating of particles for the display of life? It is quite true that if any of the ingredients in which life appears were withdrawn, "that all vital phenomena would come to an end," but it does not prove that these things generate the life. None of the ingredients in their pure state could sustain life. In water fish live; disintegrate the water, in neither of the gases could they breathe. It is the same with air. Death, or change, means oxidation, *is this* rest?[2] "The complexity of the composition of the bioplasm or protoplasm is the cause of the deleterious action resulting from light. It appears to take effect on the hydrogen and not on the carbon particle" (*Downes and Blunt*). If water be but a bioxide of hydrogen this result is to be expected, but it does not militate against vitality being a principle independent ot the ingredient, although it may prove that the methods by which nature works are antagonistic individually, but sustaining when collectively aggregated, an undue preponderance of one element being detrimental to the exhibition of other elements or lead to their obliteration. The rule and method in all the variations of nature appear to be decay and recuperation, *i.e.* change.

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[1] When it is affirmed there is no such state as death, the general idea of the term is excluded. The common idea of the change termed death is the conclusion of life, *as an existing conclusive fact*. Scientifically there is no death, because science shows death is but the static state of the dynamical. By the recuperative powers of nature all living things are tending to death, *i.e.* to the static or latent state, and all dead things are tending to life, *i.e.* to the active or dynamic state.

[2] The experiments of Downes and Blunt go far to prove that the influence of light results in the gradual oxidation of the bioplasm; light acting on the common forms of bacteria prevents their development, has more influence and is more rapid than upon *mycelial fungi*, which have a tendency to appear "on cultivation fluids." The action appears to attain its *maximum* in the waves of the greatest refrangibility. It is demonstrable in yellow light, but sinks to a *minimum* in the red end of the spectrum. M. Chataling found a number "of organic bodies" oxidised under the influence of light.

What is the insisted upon "*potence of matter*" pronounced to be "the hypothetical states of our own consciousness" but the capability of being moulded into form? There is neither individualism nor persistence in it. Potence means power, but of what? When we read of the facts of phenomena as exhibited by nature we find a plastic material with *no* creative power, *a passive acceptation of form infinitely diversified by active forces*, the units, through the activity of which animation ensues. Thus life becomes consolidated through heat. Phenomena then are due to vitality, not created by the substance in which they appear, but by *gathering and agglomerating the environments* and by *amalgamating and presenting them in new forms vitality creates them*, as the polype creates the rock through its living energy, and the mollusks and crustacæ renew a crushed shell or form anew a rent-away limb.

"Eternal matter," "impossibility of spirit on the face of matter," and other *olla podrida*, we meet with. Have either been defined? Tyndall has attempted a definition of matter. Accept it *cadit quæstio*. It is the same in the attempted definitions of spirit. Why is this? Because the reasonings are only in perception. Even Kant only idealizes; his ultimate conception is a perceptive formula. Nature in her phenomena is pronounced to be the tentative exegesis of a finite conception. But what is her fact? *Infinitely diversified presentments directed to a purpose. The revelation of an infinite conception embodied in matter and symbolized in perception. The creating energy and its resultant life, as an ultimate, is spirit, in its mundane aspect, conception, the two so intimately blended in man, that when we perceive the one in our inner energy we conceive the other.* When matter passes from perception where is its continuity? Not in the thing which, even if it be the symbol of a some-thing, we know nothing of it. It has faded from our purview as though it had never been perceived. Conception displays the true continuity as spirit. We perceive it in the vital fact of cohesion; we conceive it in the consciousness of thought. The material continuity is always continuing (in rehabilitation), not as mass added to mass, but in its primordial initiation. Mind is the aggregation of itself on itself, not merely in its own fact but by the collected facts of all other individualisms,[1] and so long as the vital continuity of the material organism is intact the mind is exhibited as an effect; when the organism fades from it, *i.e.* when its vital cohesion severs, if there be continuity it is a continuity of mind, as intelligence or spirit. The mind exists, and by development it passes to a state beyond, and if the development hypothesis be truth it becomes spirit as spirit—intelligence unembodied. The idea of embodiment is a finite conception. We know mind only as embodied, and therefore conceive spirit as embodied. Intelligence is embodied thought, itself unembodied. Where in its passage from mind to mind is its embodiment? Thought, as a persistent unembodied fact, has reality in our conception. By a parity of reasoning we arrive at the conceptive possibility of an unembodied intelligence, and also at a vital continuity in an unembodied substance, principle, essence, or spirit, whatever the phrase? This *unembodied intelligence* is the conscious fact of *intellectual existence*, and thus becomes an all-absorbing consciousness.

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[1] Romanes classifies ideas as concrete and abstract, a concrete idea being the memory of a perception, an abstract idea the mental abstraction of qualities which a whole group of objects may agree in possessing. Abstract ideas are, he states, divided into simple and complex (the simple as that of food), being performed without language, *i.e.* by "the logic of the feelings," whilst the complex can only be formed by the help of words, and are thus comprised in "the logic of signs;" and after explaining

When we speak of an *uncaused cause* we speak of spontaneity, an inbreeding in itself in relation to an antecedent impulse. If the unit of life be the real atom, then we have matter aggregating to itself that in which life exists, not as a fact of matter or of substances, as we know them, but of vitality; and in accumulated vitalities,

the association of ideas, he holds that the fundamental principle of mental action is merely an obverse expression of the most fundamental principle of nervous action, *i.e.* of reflex action. He says, "It may be taken for granted that a series of nervous discharges taking place through the same group of nervous arcs will always be attended with the occurrence of the same series of ideas; and it may be further granted that the previous passage of a series of nervous discharges through any group of nervous arcs, by making the route more permeable, will have the effect of making subsequent discharges pursue the same course when started from the same origin. And, if these two propositions be granted, it follows that the tendency of ideas to recur in the same order as that in which they have previously occurred is merely a psychological expression of the physiological fact, that lines of reflex discharge become more and more permeable by use. But all reflex action, even in the brain is not accompanied by ideation. It is only cerebral discharges which have occurred comparatively seldom, and the passage of which is therefore comparatively slow, that are thus accompanied. Habitual actions become automatic or are performed without thought. And this latter fact is important, because it serves to explain the origin of numberless animal instincts as cases of 'lapsed intelligence.'" After many observations and instinctive illustrations, he assumes that animal intelligence, so far as it goes, is identical with human intelligence, the only difference between the two being that animal intelligence is unable to elaborate that class of abstract ideas the formation of which depends on the faculty of speech (*B. A.*, Dublin, 1878). The sum of the whole is a material hypothesis of mind. His illustration of the pike is very apposite. "The pike requires three months to learn the position of a sheet of glass in its tank, and when once the association is established it is never again disestablished, even though the sheet of glass be taken away." This is the pertinent presentment of all who reason in their perceptions. They perceive matter, and can only think matter. Thus intelligence is reduced to the mere expression of nervous irritation. (Something like this Erasmus Darwin said a hundred years ago, ***plus***, intelligence as spirit and a God).

by development, we arrive at nature as a phenomenon.[1] In attempting the same mode of reasoning in relation to the uncaused cause we are at fault. We can reason on the familiar facts of perception, but when we come to the facts of intelligence, the faculty of reasoning on them leaves us; we know intelligence as an effect—we know it as contradistinguished from that we term matter. When the facts of life are mastered, the mysterious workings which underlie our facts evade us, as though it were impressed on the face of nature that there are no laws or facts resulting from law which do not stretch further than the human intellect can penetrate; we only arrive at objectivity and subjectivity.[2]

The metamorphoses of the invertebrata in their general features were known to the ancients. Modern observation discloses that creatures arrive at maturity distinct in sex and perfected in their form, undergoing in life no further change. From their eggs come creatures differing in generic form, possessing no sexual organs, and yet when at maturity producing a progeny which, after arriving at a certain progress in development, will revert to the original type. The *Acalepte*, or Medusa, a free swimming creature, the eggs produce ciliated infusoria, which when matured in their organic character, become fixed and immovable, assuming a polypiform appearance, and produce by gemmation a fresh progeny of free-swimming creatures, individualized in sex, never fixed, and after a series of changes assume the original type, that of *Medusa*. In *Zoophytes*, in the bell-shaped polype, or *Campanularia*, similar changes occur; also among the *Entozoa* and the *Distoma*, parasites found in the liver of fresh-water snails; this second generation has been classed as *Ecaria*, the form being distinct; the *Ecaria* again enter into the organs of the snail, and assume the perfect form of *Distomæ*. With the *Salpæ* (mollusks) an alternating solitary and social generation is always recurring. The *Aphides* (plant-lice) present a curious generative fact. In winter the parents, after depositing their eggs, die; the young, when hatched, are all wingless, and all females, ten or eleven generations follow, all females, and all become mothers of fresh broods. In the autumn males are born; these impregnate the last generation, which become oviparous, and lay the fecundated eggs, and the same round of vitalization occurs. Wallace (*Theory of Nat. Selec.*) instances butterflies where the different sexes have different colours. The males are always white, the females yellow, red, or black; the males, whatever the colour of the mother, are invariably white, the females the colour of the mother. The same peculiarity has been observed with some ants and beetles. This, in a degree, shows how species could merge into classes, and makes intelligent the observation that "one existing animal has not been immediately derived from another existing animal, but all are descendants of common ancestors," developed in different directions, "differing from the parents, but in essential characters intermediate."[1]

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[1] Galen says, "In vegetables there is a peculiar power of sensation, by which, although incapable of sight, &c., they can distinguish between those particles of matter which nourish them and those that will not, attracting the one and repelling the other." With modifications, we have Béchat's doctrine of organic sensibility.

[2] We have perceptive facts, and a conceptive idealization of the chain of facts. The authors of the Bridgewater Treatises fail to show objectively the causal fact. They showed that intelligent design underlies the methods of nature, and that beneath every effect there was an antecedent effect, which traced back to a single initiation they unhesitatingly termed God; if it be not that which every thinking mind accepts as God, what then shall we call it?

"Man the object is separated by an impassable gulf from man the subject, and there is no motor energy to carry it without logical rupture from one to the other" (Tyndall). Man the object is organized man, man the subject mental man; and if, as Helmholtz says, "the muscles at work" "must obey the nerves which bring their orders from the brain," it would follow that both the natural and logical disruption would occur if the subjective had not the control of the objective. The brain being the centre of nervous action, there needs "no swing of the ideal" to help us "to arrive at the naked truth more rapidly than by the direct processes of the understanding," intelligence being the subjective fact of man.

Tyndall says, if we examine the materials of the earth's crust we find them for the most part composed of substances "whose atoms have already closed in chemical union, whose mutual attractions are satisfied. . . . Granite consists of silicon, oxygen, potassium, calcium, and aluminum, the atoms of which met long ago in chemical combination, and are therefore dead" (*Force and Matter*, F. S.).[2] So would argue Democritus and Lucretius. Dead! In the kingdom of nature, where do we find the dead?

> "Look nature through, 'tis revolution all; all change; no death."
>
> —*Night Thoughts.*

Life, if it be the universal fact of the Kosmos, the distinction between a living universe and a living monad is then but one of degree. Raine says it is difficult to watch the building up of a crystal, owing to its rapidity of *growth;* the formation in viscid solutions was much more slow, and in important modifications they were "obviously comparable" with the growth of organisms. There is first a faint nebulosity at the line of the union of the solutions, in which, after a time, sperules are seen; later, dumbbell like bodies, showing that the growth of crystals and of animated things is essentially similar in kind. Graham held the slow growth of organisms was in accordance with colloidal changes. If in crystalization there be a similarity to organized forms, how can we deny the same principle of action to amorphous bodies? The plasma speck is an amorphous substance. Thus the same law modified by conditions appears to be that of the inorganic and the organic. If full force be given to the theory of evolution,[1] we have commencements continually prolonged in ever-varying formations. Vitality, an engine of the Cause; the cause of its fact is to be sought in an underlying intelligence embodied in form.[2] This intelligence, although denied, is the "beneficence" and providence of the cause. There are no accidents in natural changes, for the intelligence by which nature is formulated is present in every change. Every effect has its due sequence. Nature has no waste; everywhere there is a simultaneity of apposite tendencies. That termed waste everywhere carries with it the conditions of repair, or change; the dead refuse becomes the living substance, and the purposeness of its presentment is pursued through endless variations; the refuse of an organism, or of a force is the life-combination of another organism, or in amalgamation as another force, the rule of order is universal, therefore always recurring.[3]

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[1] "However great may have been the intellectual triumphs of the nineteenth century, we can hardly think so highly of its achievements as to imagine that in less than twenty years we have passed from complete ignorance to almost perfect knowledge on two such vast and complex subjects as the origin of species and the antiquity of man" (*Wallace*).

[2] Reyer, Vienna, ("Eruptions and Volcanoes"), comes to the conclusion that a highly heated magma within the earth's crust by infiltration has become charged with liquid and gaseous materials, rejecting the principle of German petrographers as untenable. He insists that portions of the same magma under different physical conditions assume a granitic, porphyritic, or a vitreous structure, and shows grounds for the inference that masses of granitic structure are being formed at the present day (*vide Nature*, vol. xviii p. 91).

Any theory of life however it arises—whether it be a consequence of matter, of germs, or other modes of action—must find its results in a conditioned spontaneity, and thus is resolved into a spontaneity of the cause, or into a direct act of creation; there is no room for evasion. We may talk of methods and modes for ever, and show how this results and that; but when all is said we only disclose animated substances as vehicles through which the vital principle achieves its object. If it be said that the evolution of life is the inevitable result of the law of matter, it is a spontaneity of the law, hence the spontaneity of the antecedent of the law. We may then say that the spontaneous origination of life is the direct consequence of the intelligence which underlies nature, a link in purpose constituting a bond of continuity never severed. To declare vitality to be a direct act of creation would involve confusion; as it is impossible to suppose, considering the relations a Creator must have with the Universe, that he *directly* interposed the life in each variation; but when life is viewed as a link in the chain of effects, the result of the cause, however pressing in its importance the admission may be, we fall back on a Spontaneity as the resulting facts of conditions expressed as phenomena.

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[1] Systems of arrangements have lost much of their importance in consequence of Darwin's theory. The idea of a gradual growth and progressive development breaks the artificial barriers imposed, as species, genera, &c., raised around groups, which, after all, are only attempts to express shades of difference existing among creatures. Formerly they were of importance to naturalists. It also increases the interest contained in *relationship*, using the word in a real, not in a metaphorical sense.

[2] The rule of nature is, that all things should subsist on other things, whether the organization be a crystal or a man. If the crystal had consciousness of feeling it would give expression to it, and inquire why it should be disintegrated that the ova may be developed? The same plaint might be made by the organizing (gases) substances; were not nature a compendious whole all would be confusion, but as it is, the organic bursts into life, and life flows in strata.

[3] The stomata (breathing pores) in the leaves of plants are connected with the fibres by which the carbonic acid in the sap is secreted, and which is purified by the oxygen, the life of the plant. In plant life there is an analogy to the respiratory animal facts—in the *Dionea muscepula* a juice analogous to gastric juice is secreted, by which it macerates insects and raw meat. Voltaic action will deposit metals in solution (electrotyping); one metal will be dropped and another gathered up, showing a power of selection. If inanimate matter possesses this power, can it be denied to animate substances? Call it actinic or chemical action after all, probably it is but a name for the magnetic action of the sun.

We have many hypotheses of the advent of life on the earth, but all appear to be built on the evasion of the ultimate, or are equivoques. If there be an intelligence underlying the facts of phenomena we can only conceive life to be the predetermined act of that intelligence, and so necessarily important a link in the sequence, that if animation did not arise, Nature would not be. If it be denied that there is an intelligence underlying nature, or a cause, or a God, it is an absurdity to talk of Law. Life, then, were an idle dream, a fortuitous accident, and if it be comprised in itself there can be no wonder there is a disease Peschel calls "weariness of life," for life then would be but a succession of changes, without object, without purpose, unless it be of suffering, or, as Bain says, pleasure in the distance or pain in the distance." Of what distance?

Given all the facts physiologists have found in the human organism, we have a machine with perfect conduction, and in its largest consideration, an engine or machine for the display of effects; it is animated, and has reasoning powers. Engines are constructed by art which have motion, a recurring memory, and voice, all resulting from external action, force, and electricity, but it is not supposed the engine creates the motion, the memory, or the voice. In these we have an exemplification of method, not of Creation. Methods by which all the facts of life are wrought may be simulated by human ingenuity. The present advanced stage of mechanical and scientific knowledge might lead to the expectation that an automaton could be built which could move and talk in a given direction, recording facts exceeding that of the human organism, inasmuch as the voice could be heard miles off, with a memory unfailing. We should have a simulation of human power beyond the capacity of humanity, but it would possess a finity dependent on its materials and its machinery. One derangement, whether by wear or accident, and the automaton is ruined. It may be answered that the living machine is dependent on the perfection of its organization for the maintenance of its action. The important distinction is, that its waste is repaired by an internal action, in, but not of, the machine, and the sounds uttered are the resultants of a will, which can alter and direct them. The machine memory (phonograph) expresses the sounds directly impressed. In both examples we have an antecedent—in the one life and intellect, in the other intellectual manipulation—in both an idea objectively presented. If it be admitted that in both cases intellect is the antecedent, then in neither case are the mechanics the creating fact. The mode or method of action is distinct from the initiating impulsion. Mechanical methods may proceed in successions, as in a series of wheels interacting on each other, thus becoming a united whole. In the working of the machine we see the method of the action, but if the impelling force were hidden or undiscoverable, we should talk of self-action, and say each wheel was the factor of the subsequent wheels; a cog placed in one of the wheels, and the motion is gone, unless the motor power could clear the obstruction. Should we say that the machine created the motion? or, should we say that the motion was the method of an action not disclosed? The materials constituting the machine have no part in the method of its display; they are but the necessary complements to produce the effect. When the subject of analysis is the living machine, investigators assert the vehicles of action are the factors not alone of the motions discoverable, but also of the hidden motor energies by which the method or modes of action were instituted and continued, and more, they contend that the materials—inorganic elements—themselves in their ultimates, lifeless, formless, imperceptible, create the impulsions by which they are agglomerated, manifested, and directed. This arises because the physicist observes the perfect machine, which moves, speaks, and directs its own actions, and because the physiologist and anatomist cannot discover the originating motor forces (vitality and mind). The machine is moved and directed by unseen energies, and because they are in the machine, they are declared to be of the machine, *i. e.* the results of its components.[1]

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[1] Lewes says (*Life and Mind*), "The true notion of causality is, viz. the precession

Mind cannot be said to be a vital manifestation, because we find perfect life existing without mentality; but no where do we find mind, nor any consciousness of fact, without a manifestation of life. Consciousness is both a life fact and a mental fact. The organism can be presented in its perfected arrangement of parts, and the life not be in it; yet if the life was the creature of the organism, so long as it remained intact in form, life would be apparent. When the life has faded from the organism, the organism is dissolved into its original inorganic elements. *Such evidence should outweigh all suggestive materialistic subtleties.* "The inseparable kinship of mental and vital phenomena" may be conceded, for kinship has its application in a common basis, which we find in intelligent design; life and mind thus become *kin* facts to perpetuate a purpose.

When it is said the vitality of the monad and of the man is the same, the statement has reference to the distinctive fact of origin; the vitality of the monad and man can only be the same when we let "drop all concrete differences;" the first *may feel it feeds*, the latter *feeds*, *feels*, *and thinks*. Life in its origin is comprised in its fact, however differentiated, it may be a speciality, but not the less is it the fact of its own speciality. We can speak of the life of the plant organism, the animal organism, the human organism, and the world organism, in virtue of the life speciality; the vital principle is the same in each, differing only in its manifestations. The life or vitality discloses the mode, but not the factor of the mode. In the delineation of a mode we may have a succession of effects proceeding from a primordial cause. It is true an effect inducing an effect is the mediate cause of that effect, but how a succession of effects can be "a procession of causes" is not clear. Can we assume effects to be mediate causes? the product of a single cause, the cause being merged in successive effects? If so, the cause would be obliterated in the effect. This is not consistent with what science discloses of phenomena. An effect may be obliterated, but the cause is always substituting other effects for those obliterated or changed.

If we are to be frightened by it being said to think or reason in a common sense mode is to "vitiate scientific canons," few men would think or reason at all. The finite in its fallibility discovers defects, seeing disorder where order alone reigns; in the comprehensiveness of nature differences fade into homogeneity and its resulting

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of causes,—the combination of factors in the product and not an *ab extra* determination of the product. In vitality and sensibility we are made aware that the causes are *in* and not outside the machine; that the organic effect is the organic cause in operation; that there is autonomy, but no autocracy, the effect issues as the result of the co-operating conditions."

order. Scientific canons are a series of givens, *i. e.* authoritative dogmas, but givens are always open to question. To question a theological given, in the scientific idea, is right; but to question a scientific given is a heresy not to be forgiven, as Dr. Crookes experienced. To whatever cause specialists may assign the presentments of the Kosmos, when all is said which can be said, it is found to be intelligence embodied, and thus made objective.

If we understand that every particle of substance is capable of becoming a life bearer, then the origin of life would be divested of its mystery. Vitality in a latent or active form would be present everywhere, and when conditions were suitable the life would appear. The whole difficulty arises from the denial of the spontaneity of life. Were it possible to penetrate to demonstration the hidden facts of nature, it probably would be found that there are no particles of the globe, from the core to the circumference, but were primordially consolidated through vital energy, and that this vital energy was first displayed by the infusorial "jelly blobs," these being but agglomerated gases. To talk of matter as being a special combination is to create difficulty, but if all matter be organized by the vital principle, we have a present and universal potence, and it is easy to conceive a spontaneous bursting into life. As "nature makes no leaps," it would follow that the primordial presentment of life is always recurring, the latent or static energy[1] or potence always working for its active state. In the crystal we have the working life energy presenting forms;[2] if in alum the crushed form can be repaired by an immersion in the mother lye (Paget), it is probable all crystals can be similarly repaired. Art can make a machine, art can disintegrate an organism, but art cannot restore it, nor can it make a vital organism. Art's work, like nature's work, is an accumulative progression. The simple stringing a bow for the propulsion of an arrow was probably preceded by the throwing stick, and that by the sling, and it by the propulsion of a stone from the hand—all art works, and all accumulative. There is no need to flee to mysteries or to the spiritual to find out modes or methods; it is their motor fact which defies scrutiny. The motor fact had an antecedent, and for this antecedent direction we fall back on intellect.

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[1] "Statical energy is another term for latent force" (Wm. Thomson).

[2] Plücker has shown that crystalline bodies take a position to the lines of magnetic force dependent upon their optical axis (*i.e.* the direction where they do not doubly refract light and point diamagnetically to the lines of magnetic force), or axis of symmetry; and when there is more than one optic axis, the resultant of these axes points diamagnetically (*i.e.* transversely), in some cases very markedly. He says cyanite arranges itself so definitely to the terrestrial magnetism that it might be used as a compass needle (*Correl. Forces*, p. 231).

Is there more assumption in the vitalist assuming that life is a principle unallied to matter, using it alone as the vehicle for its display, than in the materialist assuming that life is the product of matter? Observation shows that certain conditions are necessary in material combinations before the life is exhibited, and although the ingredients are traceable to the inorganic, yet the combination is unlike that we familiarly know as matter. The organics may be mixed and manipulated without an organism resulting, because the proper mechanical and chemical admixture is never attained. Forces act on matter without being of it. Yet we never find matter without heat, or an organism without the static or dynamic life. All perceptive things have the potence to become: by the power of opposites,[1] by the conflict of the forces, we have phenomena. Nature working by mechanics and chemistry is a producer and reducer. There is more evidence that life and mind are unallied with matter than that they are the products of matter. When Harvey propounded his axiom, "*omne vivum ex ovo*,"[2] *he* saw that the spontaneity of life was in the spore or germ, and fell back on the ultimate cause. When the axiom was changed to "*omne vivum ex vivo*," then were pictured matured organisms as known by observation. Harvey dived into the far away past. In the beginning was the "*omne vivum ex ovo*," an always continuing, a spontaneity always resulting, for all life is from the egg or spore. From the homogeneity of resulting facts it is probable elemental substances subsist in one primordial principle, which through condensations and changes, more or less heat, or more or less motion, electrical, magnetic, and light actions; the variations of change would induce all the diversities we know. Heat becomes work, and work becomes heat, &c., in the mechanism of nature; but art fails to devise that reversible machine which reinstitutes the changes.

What are affinities but life facts? Lead will absorb sulphur when iron is not present, but when the iron is present it will absorb its portion of sulphur, leaving the residue to the lead. It is the same with animal tissues; try mechanical or electrical stimuli on an epithelial cell, and no ciliary motion is excited; but add a minute quantity of soda or potash to the water in which the cell floats, and the cilia are excited (Virchow). This shows that in affinities, although chemistry claims them, there is something more than chemical action. Capillary action is something of the same character; all loose particles of cotton must be removed from the web, in order to prevent the dyes running (Madden). Inertia is a force in nature, although negative in character; for that which would cause a conflagration (unless instant in effect) may be innocuously transacted in the presence of the most explosive compounds, because the inertia of the environments is not overcome. From the same cause, when dynamite is exploded the rock beneath is shattered, because the inertia of the air resists the impulsion, and acts, like a released spring, on every inch of the surface of the gaseous exhalation of the exploded compound. In the living organism there may combine the crystalline life deposition on surfaces and the action from the centre. In organized forms we have the double action as the result of the vital principle.

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[1] Joule proved that heat is converted into work, and that the unexpended heat is economised by the environments. In the phonograph we have sound converted into work, dotting and marking a plate, which work is again convertible into sound. Conversion and reconversion is the secret of nature.

[2] The *primordium vegetale;* this was "egg-like," not because of its form, but because it has the constitution and nature of one. That this *primordium oviforme* must spring from a living parent is nowhere expressed by Harvey; and all he says in the *Exercitationes de Generatione* leaves the impression that he believed in spontaneous or equivocal generation (*Critiques and Addresses*, p. 220).

The laws of physics present the method of nature only. The movement of a limb is a fact of dynamics, and the change of a tissue may be chemically brought about by the decomposition of a carbonate. An electrical phenomenon may be observed in a muscle;[1] but all this only proves the rigidness of the law of force, *nature working by means*. The distinction between the physical and vital movement is, that the first is without (outside) the body moved, the latter within the body; but even supposing that all actions of the body are purely physical, the institution of *direction* shows they were the results of an intelligence acting on the mass, transfused within the mass, but not of the mass, because the agglomerating fact must be the antecedent of the agglomeration.

If we liken the contractility of a muscle to the mechanics of a pulley, then, as Lewes remarks, "the movements of a pulley do not depend on contractility and sensibility." Further, he says there is "a misconception of this mechanism, as if the dependent actions were of the nature of machines—that is to say, as if organized mechanisms were strictly comparable with machines constructed of inorganic parts," and "in the elaborate parallels between steam engines and animal organisms . . . there is a complete obliteration of all that speciality (which) distinguishes vital activity." In organisms each part evolves from pre-existing parts:—in the machine the arrangement is of non-related parts; in the organism a string could not be substituted for a tendon; in the machine the pulley of the lever may be replaced by a cord or a chain, so in the whole there may be a substitution of wood for metal, or metal for wood. In the machine there "is a connexus of the parts," in the organism "there is a connexus and a consensus." In the machine there is no self assimilation, in the organism there is. Papillon demonstrates that animals fed with food having in it no phosphate of lime, but containing magnesia, strontia, or alumina, make bones of them, but that there is no such substitution in other parts of the organism, as in a muscle, nerve, or gland (vide *Phys. Bas. of Mind*).

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[1] Matteucci (Royal Society, 1850) showed when a current of positive electricity traverses a portion of the muscle of a living animal in the same direction as that in which the nerves ramify (from the brain to the extremities), a muscular contraction is produced in the limb, showing the nerve of motion is affected; but if the action be reversed (that is, towards the nervous centres) sense of pain is exhibited showing in this case the nerve of sensation is affected.

Vital action is the existing fact of the organism, not the mode of its existence; the mode may be purely physical. Vitality has grades; we find it in the jelly speck, we find it in man; the distinction is found in the organic development, in the same way as sounds are modified in percussion or wind instruments, drums, fiddles, trumpets, or pipes. The explosion of a pinch has not the effect of the explosion of a ton of gunpowder, yet we have the action of the same principle. The life may throb in the jelly speck, but in the leviathan it is a mighty force. The wind sighs in the zephyr, but in the tornado it crushes all in its line of march. Between analysis and synthesis the distinction is wide, yet both result in knowledge. By analysis we find the parts of the machine, but nowhere the motor. In synthesis we do not see the parts, but we do the motor fact, and by divining its principle know the general plan of the construction—the units, their unity, the cause of action, each must be considered, and to each must be assigned its relative place. There is an emphasis in the fact that a Cuvier,[1] an Owen, or a Huxley, by being possessed of the tooth or the bone of a creature, could predicate the form and build, not merely a hypothetical skeleton, but the resemblance of an actual life.[2]

Life is the consequence of a principle, which by inbreeding on itself reproduces its kind with a power of variation, centralizing in itself.

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[1] Jefferson found a fossil bone which he assumed to belong to an extinct vertebrate. He called it the *Megalonix*, a huge carnivorous animal—a lion of the size of an ox, and fitted to cope with the Mastodon. This bone came under the scrutiny of Cuvier. *He found a spine in the nodule of the articulating surface of the last bone.* This afforded the key to the solution of the problem. On tracing the curve he showed that the claw must have been of such a length, that it could never have been contracted so as to preserve an acute and sharp point, it never could have been raised vertically so as to have permitted the creature to put its foot to the ground without blunting the instrument. These facts did not agree with the construction of the foot bones of the tribe *Felis* (lions), but agreed with those of another order, that of *Paresseux* (sloths) and he came to the conclusion that the lion of the American President, was an animal that scratched the ground and fed on roots (*vide* Bell, *B. T.*, p. 97, *et. seq.*)

[2] A principal guide are the processes of bone to which the muscles are attached. So unerring is the law of nature, that a comparative anatomist builds again the figure and assigns it to the order, genera, or species to which it belonged. Whether web-footed or adapted for speed, grasping, tearing, burrowing, flying, &c. By a single bone he can estimate not merely the size of the animal but the form and joints of the skeleton, the structure of the jaws and teeth, the nature of the food, and the creature's internal economy (*vide* Bell, *B. T.*, 7).

The indication of life is that cycle of changes we know as phenomena, summed as a generalization, *a conditional spontaneity.*[1]

Lewes defines organic substances to be non-living, but capable of living or not capable of living, as being of waste; organized substances, as a specific combination of organic substances of various kinds, an organism being the result of their combinations. *In nature there is no waste or dead stuff, for although prodigal in her means, she economizes every particle.* All things are of use and put to use; the refuse cast on the muck-heap becomes a teeming life. As all substances can be reduced to a gaseous form, it seems to follow that all substances are capable of organization. It is said one part of a crystal is identical with every other part; in an organism one part is unlike another part; yet in the protamœba every part is like the whole, for the whole is but one part. Crystals are like crystals of the class, but when compared with all crystalline substances, there are diversities of form and material, although their condensation results from the same principle. In an organism of a complex character we have the collective facts of an organization. Cells differ from cells, as crystals differ from crystals. If we take a distinctive cell-formation, we have the same identification of structure as we have in a special crystalline formation. It is the same truth, crystal or organism, whether each part is like its corresponding part, but unlike the whole of the classes into which they may be divided.

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[1] There are many definitions of life. Aristotle distinguished it from the vital principle, for life means self-nourishment, self-development, and self-decay, hence is not the vital principle. Kant defined it to be an internal principle of action, that every part is at once a means and an end, each part of the living body having the cause of existence in the whole organism, whereas in non-living bodies each part has its cause in itself. Müller, J., says, the harmonious action of the essential parts of the individual subsist only by the influence of a force which is extended to all parts of the body, and does not depend on any single part; *this force must exist before the parts,* which are in fact formed by it during the development of the embryo. Beale calls it a peculiar force temporarily associated with matter, which is capable of controlling and directing both matter and force. Schelling, a principle of individualization, a cycle of successive changes, determined and fixed by this internal principle. Bichat, the source of the functions which resist death. Dugé, the special activity of organized beings. Bechard, the sum of phenomena proper to organized beings. La Mark, the state of things which permit organic movements, and that the movements which constitute active life result from a stimulus which excites them. De Blainville, life is the twofold internal movement of composition and decomposition, at once general and continuous. Owen, life as a centre of intussusceptive assimilative force, capable of reproduction by spontaneous fission. H. Spencer, life as the continuous adjustment of internal relations with external relations. Lewes held life to be a series of definite and successive changes which take place within an individual without destroying its identity; this definition he withdrew as defective, substituting "the functional activity of an organism in relation to its medium, as a synthesis of three terms—structure, aliment, instrument" (vide *Life and Mind*).

Life is the sum of the functions which are the resultants of vitality, vitality being the sum of the properties of matter in a state of organization; thus, every act done in and by an organism is a vital act, though mechanical and chemical agents may form its essential components. "Every part of a living organism is therefore vital as *pertaining* to life, but no part has this life when isolated, for the life is the synthesis of all the parts."

Organized substances are amorphous, liquids, semi-solids, and solids, figured as cells, fibres, tubes, and tissues, which are resolved into organs, having volume, structure, and chemical reactions. The most simple form of life, "the jelly speck," is called *Sarcode* by Du Jardin, germinal matter (bioplasm) by Beale, *Citode* by Haeckel, protoplasm by Huxley, and although said to be destitute of texture or organs, it is a living substance manifesting the phenomenon of reproduction. Kühne and others hold contractile matter to be protoplasm; a rhizopod will put forth from its body a temporary arm, and slowly wrap itself around a microscopic plant, converting its whole body into a mouth and a stomach.[1]

The cell theory of Schleiden and Schwann (1838), the basis of modern histology, supposed the cell wall of importance; Coste (1845) showed there were cells without walls; (1855) C. Robins, Brücke, and Beale considered this difference of great importance. Cells are now considered as a nucleus with a surrounding protoplasm; the cell walls as an accessory, and not as a necessary constituent. A cell may lead an isolated life as a plant or as an animal, or united with other cells may lead a corporate existence; but whatever its state, it preserves its individuality. A cell is found in contact with similar cells, as in the filament of a conferva; rising higher, there are cells united with others differing from it. Plants are composed of cells. Still higher, we find animal forms, the webs of which are woven of myriad of myriads of cells, with various cell processes, fibres, and tubes.

Every substance has, *first*, a relativeness to its constituent elements; *secondly*, a relativeness to surrounding objects. The laws of life are also relative; the organizing force develops by adaptation and heredity, *i.e.* the reproduction of the original form, together with acquired modifications. First, there is the medium or vesicle, in which the life appears,[2] and which has a power of

[1] Cienkowski says, a monad will "fasten on a plant and suck the chlorophyll first from one cell and then from another; another monad, unable to make a hole in the cell wall, thrusts long processes of its body into the opening . . . and drags out the remains of the chlorophyll; . . . when a third monad, leading a predatory life, falls upon other monads filled with food. Here," he says, "we stand upon the threshold of that dark region where animal will begins."

[2] Of a medium, Claude Bernard says, the conditions *first* are, "an external Kosmical medium embracing the whole circumstances outside the medium capable directly of affecting it. *Secondly*, an external or physiological medium embracing the conditions inside the organism and in direct relations with it—*that is to say*, the plasma in which the tissues are bathed and by which they are nourished." There are besides temperature and electrical conditions. Agassiz says, the most diverse types of animal and vegetable life are everywhere found under identical circumstances, whether it be

assimilating substances, to maintain growth and to repair waste. Mill, Spencer, Huxley, Tyndall, and many others, seem to consider that nutriment is the integer rather than the incident of the organism. The organism, once in being, its continued life depends on a concurrence of definite conditions; oxygen may be destructive to some forms of life, whilst others could not exist without it. In consequence of the chemical combinations, the organism is as sensible to external conditions as it is to those which are internal, through the selective powers of the vital principle.[1] By some this selective power is denied, because poisons are imbibed. The answer is, the selective power of the vital principle is displayed *in the assimilation* of the pabulum, not in a *discrimination* of the material; this distinction shows the grand line of demarkation between vitality and intellect. The living principle acts by its chemical powers, by disintegration, admixture, and assimilation; deadly poisons are absorbed through affinities, and have their antidotes.[2]

Lewes calls the nutrient material, plasmode; the name is immaterial, the protoplasm being the substance constituting the vehicle, living, when vitalized. Vital action is not altered in function by being called the mechanics of chemical action. The principle by which consolidation was first induced is active through all time, and vitality has its perpetuation through the law directing it. Where shall we look for the instructor of the law if not to the Great Chemist and Mechanician who presides over and superintends it—the Providence of natural phenomena?[3] The dream is as idle which refuses to accept mechanical and chemical facts as the proximate formulators of nature, as that which assumes that life and mind are the absolute consequences of material combinations. The aggregation and the assimilation of

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in salt water or fresh, dry land or marsh; so uniform indeed the fact, the inference follows that the same physical causes can produce the most diversified facts.

[1] Vital selection is seen in the adaptation of *phosphates* to several uses, as soda in the blood serum, potash in the nerves, magnesia in the muscles, lime in the bones. The blood is the most liquid, the nerve a degree less so, the muscle still less, the bone almost entirely a solid.

[2] A dog was accidentally poisoned by strychnia; the creature lay on its side perfectly rigid, with occasional tetanic spasm, and was restored to health by the administration of chloral hydrate (*Nat.*, vol. 17, p. 360). Strychnia in combination with iodide of methyl changes convulsions to paralysis.

[3] Wherever in nature food is to be obtained there are structural contrivances to reach it. Supposing a horse run down by a wolf, it is fed on by carnivorous birds and animals. In the bones there is a store of nutriment. The hyena, with his peculiarly constructed head, jaws, and conical teeth, crushes the bones and obtains the marrow. This same characteristic runs through the whole of the animal race. The wild boar, the elephant, the giraffe, the elk, the ant-bear, sloth, and the mole, are feeders of a different character, yet each organism is exactly suited to its particular economy.

the organic particles may induce molecular changes, but these changes must depend on an antecedent. Without intellect art were impossible; and by analogous reasoning we say, without a formulating intellect nature could never have been. Intellect could not have arisen from *moulded* materials, because by *necessity* it must have been precedent to them. When once it is conceded that intellect was necessary before formation could ensue, the chemistry and mechanics of Nature become the methods by which she works. All biological learning points to this method. The intellect, though finite, which has penetrated the methods of infinite wisdom, is too great to be degraded into an emanation from the object (matter) it created.

Beale's theory, shortly expressed, is, that the minute masses of bioplasm alone represent the living matter of the organism. The bioplasm being germinal matter, out of which, by a process of dying, arise the tissues and humours constituting the formed material, these, with the pabulum which feeds the germinal matter, are all dead. The physical properties of tissues inferentially depend on the germinal matter; the constructive fact is due to function, expressed in maintenance, nutriment, and growth. Given the organism is composed of cells, its power is only that of an aggregation of cells; in the cell is the living principle (the nucleus), hence all multiplication and power is due to it. The pabulum sustains the life, does not create it. It is impossible to explain vital phenomena, even with the aid of what Lewes terms, structure, aliment, and instrument; they are the casuals, vitality the acting impulse. The property or a tissue is its characteristic quality, an organ is the combination of several tissues, and is effective by virtue of this combination (Pinel). The function of an organ is amalgamative, and directs the relativeness of organ with organ, *i.e.* in their anatomical and physiological connection.[1]

There are probably millions of jelly specks, as there are seeds which never produce their kinds. Vitality breeds the germ, but the germ does not always possess the life; if the germ originated the vitality, the life would inevitably follow by the determinate power of law. The elemental units, however combined, have no selective power. The multiplication of an organism, whether by fission, gemmation, or generation, occurs through vital action.

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[1] "Identity of tissue everywhere implies identity of property, and similarity of tissue, similarity of property. Identity of organic connection everywhere implies identity of function, and similarity of organic connection, similarity of function" (Lewes, *Life and Mind*); *i.e.* they are equal to themselves, and "every action is rigorously determined by the nature of the agent and the conditions under which it takes place."

The germ, as in the severed twig, infallibly—conditions being suitable—becomes like its parents. The aphis, the medusa, and some animate forms, have alternations in the mode of production (sup., p. 236). If it can be said the organization precedes the vitality, then it can be said structure precedes the function; there would be equal evidence of both; but is there any for either? Mechanics and chemistry as givens! what is the stress? Their combinations do not make life, because their constituents are only equal to themselves. Function may increase the capacity of an organ, and the increase may be perpetuated, although the result of the vital function there could be no display of a particular function unless the living organ existed. Growth "permits increased function," yet so "rigorously is function dependent on structure, that the hand of one man will execute actions which are impossible to another" (Lewes).[1] What follows? Structure is the result of function, and function appears as an effect when the structure is formed; *in other words*, function is transfused into the structure, *i.e.* the potence is exemplified through the structure, and created in the same way as the power which devised nature is exemplified in her phenomena. Custom subverts nature, as shown in the Chinese woman's foot, the flattened skulls of the Caribs, and other savage and semi-savage tribes, but more in the suppression of the use of the left hand among all civilized nations. Custom and nature are always at war; custom tramples on individuals, but nature, as regards race, tramples on custom. Farini, the gymnasist, says pupils sent to him for training have "a lop-handed and game-legged habit;" by custom they become so, and by custom he cures them. "By custom," he says, "the whole human race could be made as either handed and even-legged, . . . if the teaching commenced in infancy."[2] By judicious training he makes both hands and both legs what nature intended them to be. He commences by subverting custom, and thus restores the natural functions.[1]

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[1] Canine teeth accompany a carnivorous appetite and boldness of disposition; boldness, fierceness, and cunning accompanying retractile claws and sharp teeth; erect ears and prominent eyes, suspiciousness and timidity in the vegetable feeder; in other words, the arms or instruments accompanying the instinctive disposition of creatures (Bell, *B. T.*, 210). Galen says, take three eggs, that of an eagle, a goose, and viper; when matured and the shells broken, the eaglet and gosling will attempt to fly, whilst the viper will curl and twist along the ground. Protract the experiment, the eagle will soar, the goose betake itself to the marsh, and the viper bury itself in the ground.

[2] The left side is not only weaker in regard to muscular strength, but also in its vital and constitutional properties—the peculiarity extends to the constitution also, disease attacks the left extremities more frequently than the right. It may be said, the superiority of action results from the more frequent use of the right hand. The preparatory exercises for uses of the left limbs show the natural weakness, since these performers are compelled to give double practice to the left limbs (Bell, *Brid. Treat.*, p. 124). On the whole, the preference of the right hand is not the effect of habit, but of natural provision (*ib.* p. 125).

The fact that a germ represented by a line should by an interior differentiation produce such opposites as hairs, blood, bones, flesh, nerves, is no more wonderful than that minute changes should eventuate in distinct variations which, when confirmed, becomes species. The mystery of nature is not so much the differentiation, as the principle by which the differentiations are induced. To define life is to define its possibilities; the modifications then fall into their sequences ; the vital fact assimilates its surroundings ; change in particular working directions may be occasioned by the peculiarity of the elements absorbed ; chemical changes being brought about by the vital principle are not so marvellous as itself.[2] If Woolff's theory of Epigenesis be true, it is only another mode of expressing creation ; if the germ be formed anew, not merely expended by the procreation of the parents, to what is to be attributed the new formation ? All the theories, even those purely mechanical and chemical, must fall back on a concealed factor, the facts revealed alone showing the method of the working ; the homogeneity of the method shows the factor is an intelligence, or we should not have the gradations of development, as proved by the successive phases of embryonic changes. That all complex forms arose from simple forms in their aggregations and differentiations is seen in analysis. The intelligence which conceived the plan of phenomenal arrangement from the germ, could equally have presented the perfected form. There can be no question of *tentative efforts and corrections*.[3]

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[1] "By training for the strong, women can attain to great strength." Natalie, a French gymnasist, can take two 56 lbs. weights from the ground, one in either hand, and can pass them slowly over her head. Farini says, "the putting up" an agile gymnasist is nothing compared to this feat. She had a sister who tired twenty sailors going up a rope in succession. She wore out the whole twenty, who came down tired; the lady was fresh. Senyah (an Anglo-Saxon) head downwards, hanging to a rope with one leg, with a mouth-piece, to which three leather straps were attached, by them she held "three great hulking fellows dangling in the air for ever so long." Here we find examples of the efficacy of culture even in the physical, showing functional use may increase the capacity of an organ (C. Reade, "*The Coming Man*," *Telegraph*).

[2] In a solution of nitre and sulphate of soda, if a crystal of nitre be dropped, the nitre of the solution crystallises, the sulphate remaining in solution ; but if the process be reversed, and a crystal of soda be immersed, the soda crystallises, the nitre remaining in solution (Reil). This is chemical selection, such as we can conceive to be exhibited in the nutrient powers of the organism, through vital action.

[3] It is the fashion to regard creation as an imperfect conception, that the larva of the dragon fly is to be viewed with a sneer because it creeps at the bottom of a ditch, although eventually it emerges splendidly clothed and suited to every want of its nature ; and so the myriad grubs which revel in the ground and emerge clothed in mail. In insect metamorphosis there is perhaps a greater apparentness of purpose than in more prominent manifestations. There are no classes of animal forms but pertinently present a purposed formation, although it may be said that each lives for

From all we gather from the lessons of Nature, we are bound to conclude that the purpose and plan of objective phenomena were conceived once for all, and are continually in action, and we have their emphasis in the fact that as each organism progresses in its particular direction it includes in itself all the preceding stages through which it has passed.[1] By the development hypothesis the general permanent stages of the lower animals are to be found in the embryonic stages of the higher organisms. In the inorganic we have distinct crystalline forms, which take definite shapes. In organization we have specific shapes, with the capability of variation.[2] The formless germinal membranes develop into a variety of forms, sustained and replaced by the laws of succession, as surely as age succeeds to youth.[3]

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itself, yet so admirable is the adaptation that all living forms live for each and each for all. A species is but the initiatory step of the progressive advance.

[1] Von Baer showed that the mammalian embryo was never a bird, a reptile, or a fish, but yet held it passes through all the lower typical forms; and that, except as to size, it is impossible to distinguish, in certain of their phases, the mammal, bird, or lizard. He had two embryos which he had forgotten to label, and could not say to which class they belonged. The head and trunk only had appeared; even had the extremities been there, in the earlier stages they could not have been discriminated, for the feet of lizards, of mammals, and the wings of birds arise from the same general form; and he sums his formula by saying, "The special type is always evolved from a more general type."

[2] "An epethelial cell . . . may be ciliated or columnar, a muscle-fibre striated or non-striated, a nerve-fibre naked or enveloped in a sheath, but the kind is always sharply defined. An intestinal tube may be a uniform canal or a canal differentiated into several unlike compartments with several unlike glandular appendages. A spinal column may be a uniform solid axis or a highly diversified segmented axis. A limb may be an arm, a wing, or a paddle." The anatomist "never expects a muscular tissue to develop into a skeleton, a nervous tissue into a gland, or a gland into a sensory organ" (Lewes, *Phys. Bas. of Mind*).

[3] The furrowing of the egg, or yolk cleavage, "the cleavage of the spores," is merely the division of the cells and their product, "naked cells." "There then arises a mulberry-shaped bell, composed of a number of small spheres, naked cells containing kernels. These are the materials out of which the embryo mammal is constructed. The globular lump of cells changes into a globular bladder as fluid accumulates in it," the germ-bladder (*vesicula blastodermica*). "At first its walls are equiformal cells," but "at a point arises a disc-shaped thickening." This is "the body of the germ, or embryo; the other parts serving for its nutrition." The form changes to oblong, then to fiddle-shaped, through the right and left walls becoming convex. At this stage the embryo of one vertebrate cannot be distinguished from that of another. "The whole is an oblong or violin-shaped disc," "composed of three closely connected membranes or plates lying one above the other," consisting of cells exactly alike; but each layer has a different function. Out of the upper or outer germ layer arises the skin (*epidermis*) and the central parts of the nervous system, spinal marrow and brain; from the lower layer comes the inner skin (*epithelium*), lining the whole of the intestinal tube and all the glands connected with them (lungs, liver, salivary glands, &c.); out of the middle layer all the other organs (muscles, bones, and blood-vessels). Each division has relation to the others. There are repeated divisions and reunions, by means of which the different organs become gradually formed, and an organic structure is accomplished which one cell could not work out. Its result would be an amœba. Thus effects arise out of effects (by vital energy). In the central line of this disc arises a delicate furrow, the primitive streak

All forms of life are a pushing from the vital centre, the formed material being passive in the whole process, becoming rigid as age increases. The element in which the vital power reposes is said to be contractile. This can only be said of the vitalized masses corresponding with the white corpuscules of the blood (their action being distinct from the *physical* energy displayed by formed muscular tissue). In the corpuscules there is a force, inbred in itself and acting on itself, converting the non-living into the living. This conversion, we are told, is chemical action, and no more is to be said. If it be only chemistry, it is a chemistry beyond the power of science to imitate. When we talk of analogies we talk of distinctive characteristics, not of an absolute correlation. The only analogy between the vital and physical is the exhibition of an effect apparent as a force, but here all analogy between them ends. To say the two are the same is the affectation of knowledge, if it be not an insipience. Compare the mode of the chemist with that of nature, as in the fine elaborations by which acetic acid is produced. In nature there is no need of red hot tubes; the vital fact dispenses with all such aids. Carbon, the great element in all life vehicles, is used and converted by an innate power. . Who, reflecting on nature's chemistry and on art chemistry, would say that the carbon and associating gases are converted by physical force into chyle, chyme, and blood? The

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dividing it laterally into equal halves. On each side of this streak the external germ layer rises in a longitudinal fold, which grows together over it and forms a cylindrical tube or medullary canal (*medulla spinalis*). At first it is pointed at each end, and so it remains in the lancelot (*amphixiosus*). In skulled animals (*craniola*) the fore end becomes dilated and changes into a roundish bladder, the foundation of the brain. This bladder divides into five bladders, lying one behind the other, out of which arise the different parts of the brain; the first bladder forming the hemispheres of the *cerebrum*. The higher the series of the vertebrata the more do the lateral halves of the fore brain grow at the expense of the other bladders. The second bladder forms the centre of sight, and stands closer in relation to the eyes, which grow right and left out of the fore brain in the shape of two bladders, and later, lie at the bottom of the twixt-brain. The third bladder vanishes in the so-called formation of the four bulbs, strongly developed in birds and reptiles. The fourth bladder forms the little hemispheres, together with the middle part of the small brain (*cerebellum*), of which most contrary conjectures are formed, it seems to regulate co-ordination of movement. The fifth bladder develops into the *medulla oblongata*, the important organ of the nervous system and nervous centre of respiratory movements. An injury to the *medulla oblongata* would cause death or paralysis. The cerebrum can be removed or completely destroyed without immediate death ensuing (*vide* p. 116).

On a comparison of the embryos of vertebrates in the earlier stages, they are found to be almost identical in appearance. In birds and reptiles the mid brain predominates, in mammals the fore brain. When the embryos are developed they differ materially in all anatomical conditions. The formation of the brain of the embryo has been shown as an illustration; had any other part of the structure been selected the same relative closeness of character would have been observed. A chain of descent is shown; from this it would appear "that man is only the most highly organized animal" (Haeckel, *Hist. of Creation*).

life must exist before the nutriment (*pabulum*) can become effective in its purpose; the vital energy adapts it to uses. Potential energy owes its impulsion to gravity; kinetic energy to an impulsion external to itself, and is produced at will. The vital energy is no effect of will, but the production of its own powers, an occult principle, which, like gravity, is universal. What evidence is there that life has its origin in nutriment, or is due to physical force? Analyses are not made of living but of dead matter, and were a physiologist to watch an expiring life, and at the last gasp anatomise the subject, the life-secret would elude him. Although there be a correlation of the conditions of heat, it has never been proved that either can be converted into vital energy, though probably as methods they are the acting forces. In this correlation of the forces light should stand for either. Newton supposed light to be the acting energy, yet it has been shown (*sup.*, p. 233) that light is inimical to some forms of life.

What becomes of the sun theory of life, of which high names are the exponents, when the sea's bottom, many fathoms below the direct influence of the sun's light, teems with living things? If it be assumed the sun acts magnetically, then all nature is the subject of his influence. Life subsisting through heat develops heat and motion, even in a temperature many degrees below the normal. In the dark caves of Kentucky are eyeless fish; in the seas eyeless Crustacea; in dark caves are eyeless creatures, preying on other living things; in the Americas eyeless ants, which construct vast underground tunnels. What influence has light as a sensory effect on any of these organisms? Where do we find the physical force which develops the life energy, and converts inorganic elements into living organisms? We get alone the method, from the life only can the life proceed; but if the vital principle be the energy of the universe, should it excite surprise that the spontaneous production of organized forms is the fact of that principle?

The progressive changes of organic forms appear to have accompanied the geological eras, for each geological change is marked by variations in the life forms; the former types continuing, the variations resulting in the establishment of new species.

If organized life be the result of physical force, what was the force which differentiated the primordial mass? Force is never developed unless there are existing masses on which it can act; yet if it be assumed that the organized world is the result of physical force, then force necessarily becomes the creator of its own fact—creates the vehicle, through which is the exhibition of its power. If there be no vital energy, whence was this physical force? This *vis viva* of science is the inertia of the mass, and this inertia must be overcome before the forces can act. What then consolidated the mass?' Whence was the inertia of the mass? assumed to be chaotic, a moving, devastating fire! If a fire mist ever existed, then heat was consolidated into phenomena. The *vis vitæ* creates the fact of its own exhibition by an activity within, thrusting outwards that which it assimilates from the environments; creating, as it were, by its own energy; making larger its circumference, splitting and dividing, yet coalescing; creating its likes and differentiating them. Physical force may be the method of vitality as a resultant of vital energy, but never becomes vitality. With conditions apposite, life appears—the vital energy being present in all forms—and originates, assimilates, or adapts all the forces. No effort of man can change the developing force of the *ovum;* physical force can be wielded at will, but not so the vital force. If vital energy and physical force were the same, the *ovum* of a pig could be developed as a man, a *reductio ad absurdam*, and yet the true induction of the premiss. There is nothing to be made of this physical hypothesis; turn it, shift it, change it as we may, we arrive at a remote analogy, and even this only discloses the method of nature. Inherent vital powers may be physics, but no physics ever instituted the facts by which they exist; it is something like saying structure precedes the creative function. The vital force is a discriminating energy, physical force a blind and indiscriminative violence. Heat and the vital energy are both facts of, but are no creations of physics, for physics are their resulting effects. If then, physics be resultant and not causative, we must look beyond matter for the causative principle, and then can only view matter as *the vehicle through which energies are aisplayed.*[1]

Beale says, "Life power after all only *temporarily* enthrals any material particle. Matter soon *escapes* from the influence of life power, but the living matter which has *once* lost its distinctive character *never* regains it." Here he appears to ignore his own physics in order to *energize his theory*. Were this so, then indeed there were death in the widest signification of the term. What is *this dead matter*, this birthplace of putrescence, this bed of a renewal of life, but a sequence in the ever-recurring cycle of changes! This death in life and life in death becomes the whirring wheel of organic, inorganic, and organized phenomena. The forever "existing recuperative fact" is a denial of the materialistic doctrine of "nature's great progression from blind force to conscious intellect and will." When the laboratory constructs itself, the fire spontaneously collects or forms its own materials and ignites them, the chemical elements jump in and arrange themselves in the crucibles, the solutions in the beakers, the gases in the receivers, and the electric and magnetic apparatus forms itself and its conductors, we can then believe that vital force and physical force are the same (*vide* Beale's *Bioplasm* and Whewell, *B. T.*). In the cell laboratory all this is done; if it be physics it is the physics of the vital principle, of which we know alone its fact in the effect: heat and life centralizing in an electrical and magnetic gravitation, a persistent pertinacity, a spontaneity through which is presented, objectively, an intelligent causation. Thus from intelligence comes conscious life; from the vital fact, life-chemistry and life-mechanics, inbreeding the facts of physical force, by which only we learn the *modus* of life. Inebriation is a resulting fact, but no one would say the gin, beer, &c., was inebriation; although we know the ingredients of the gin, beer, &c., we do not know of what their ultimate particles consist, nor how they coalesce with the organized form to produce stupefaction; we have the facts of the method, and no more. Exact knowledge is a knowledge of ultimate particles; of these, however learnedly our teachers talk (and even though looking as wise as *Lord Thurlow looked*), of them they know nothing, nothing even of their aggregated forms, matter and force, *they know not their whence or their what.* Man's intelligence, abstractedly viewed, is an effect; matter and force are effects; so our knowledge is an effect cognizing an effect. Thus our facts become the similitudes of a predisposing something; and here we are face to face with the enigma which material science assumes to have proved.

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[1] Planta's beautiful experiments with his powerful batteries show not only that the aurora is due to the magnetic power of the earth, but that even waterspouts and bores probably are electrical effects. A grand physical result; yet only an exponent of the action or mode by which nature acts, 'showing an adaptation of means to produce a given effect.

In the materialistic view, all phenomena are purely of material origin, not alone *in their presentment*, but also in *their inception*, formed matter or its emanations; hence we *hear* more of *emotion*, the instinctive or perceptive—sensory—than we do of *sentiment*, the conceptive or mental—intelligence. Such an isolation of ideas leads to uncertainty; it is this uncertainty, being wanting of the comprehensive and the universal, which tends to the reproduction of the old-world philosophy. Lucretius suggested volition for the flying atoms; had his knowledge of force been more compatible with its fact, his system would probably have had another postulate. The material view being accepted, phenomenon becomes a mere change in animation; the physical resultings of force, initiated by the inanimate life, then would be but the reign of death, and in its eternal aspect objectless, as it would be purposeless. The material hypothesis asserts that the earth brings forth life, forms, and forces by her own *inherent power*, yet *spontaneous action* is denied to it. This is a contradiction, extending to the root of the argument. If the earth does not spontaneously produce, there is behind or beyond an influence which presents animation, forms, forces, and every other principle which as formed phenomena, we know as nature. If there be this hidden impulse, what becomes of the material hypothesis in the phase of initiating, generating, and creating?

The ultimate particles of living organisms are colourless aggregations of matter too minute to be weighed; when granular, the granules are imbedded in the living germ. The white corpuscules of the blood give rise to the red, and patches of living organism are interspersed throughout the systems of the nerves, serving as renovators and insulators. The microscopic speck, brimming with energies, assimilates materials, and converts them into structure, the vital energy manifesting itself in an exact ratio with the increase of the vesicles of life. So long as the organism continues in its compacted form of life and substance, the vital energy always objectively presents a physical effect, but the effect and its cause are distinct problems. The differentiation in the primordial aggregation constitutes the varieties of organic forms, so the skin, the arteries, muscles, and nerves are variations of the same principle, but how all this occurs is a question which yet awaits an answer. Of this we may be assured, there are *no haphazards here*, for if there were, the human germ might eventuate in a gnat, a snake, a fish, a kangaroo, or a man. The lower the geological strata, the lower appear the forms of life, as though the progression of life and the progression of elemental condensations were synchronous in action. In the tertiary, the organic form of man, as palæontologists suppose, was first presented,[1] but long eras of time elapsed before the quaternary period, when, it is supposed, man first appeared in his dual characteristic, a perfected organism, asserting an intellectual supremacy. The same action of law is observable in the progression from the sensory to the conscious sensory, from that to the conscious sensative, thence to instinctive aptitude, to instinctive mentality, to intelligent conscious perception, culminating in conscious abstraction, *i.e.* intellectual conception. Each of these steps follows the organic development and increase of brain surface. We have a pulp mass, ganglia, an incomplete brain, a complete brain, with imperfect convolutions, all preparatory to the perfected convoluted surface alone found in the brain of man, as though, through progressive steps, the causative purpose prepared the vase, filling it by degrees with the essence of direction, perceptive potences, and conceptive powers.

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[1] Evans (Dublin, 1878, Brit. Ass.) doubts whether the discoveries at Brandon have the prominence assumed for them (the finding palæolithic implements in three interglacial beds, each underlying boulder clay, somewhat different in character). Two questions are raised—that of Croll's theory of the alternation of climate during the glacial period, and how far Skertchley's record can be substantiated. Gravels containing the implements in many cases can be shown to be of later date than the chalky boulder clay; but implements to occur in successive beds in the same district, the beds being separated by enormous lapses of time, is very remarkable! "I have always maintained the probability of evidence being found of the existence of man at an earlier period than that of the post glacial or quaternary river gravels;" but before finally accepted, the evidence adduced requires sifting.

The germ from whence sprang man is not more complex in its primordial organized form than that of any other vertebrated organism; in definite action we must look for the difference in results. "Insignificantly in matter, but transcendentally in power, does the man-germ" differ from all other germs.[1] This wonderful stuff, from which the energy of all living things is developed, when the life becomes latent splits up into gas or gaseous compounds. Even whilst the vital power is active the vase is continually disintegrated, and in a short measure of time no part (excepting probably cartilage) of its original substance remains, yet the vital power repairs its own waste, completing and exuding, new energies continually recurring, until by the wearying wear the formed material becomes inelastic, and animation deserts it; or, it may be, the vital energy bursts its own barriers, and becomes a torrent. The living media, overwhelmed by their own energies, form more swiftly the red substances than they can clear away the obstructions; inflammations ensue, and animation lapses through its own energy, awaiting a renewal; the centres of vitalization always existing. When Kant traced man downwards to the lichen, it was a hypothetical conception, in many respects formally verified, and was founded on the idea that every particle of the material universe was a life-bearing substance. In this view there is no materialism, but an orderly sequence of natural law intelligently directed, no substitution of *physical causation* for the creative principle, yet withal we never escape from spontaneity as the method by which intelligence makes itself objective in form. All we gather by investigating the parts of a once living machine is the admirable adaptation of purposes to uses, and if this absolute sequence of causative effects be not of design, all evidence becomes ineffective.

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[1] It is held that the rudimental organs afford clear evidences of creative design in the progression of animal forms. The question has been canvassed over and over again; but it appears to be clearly demonstrated that all animal changes occur in the fœtus as to form—as though the organism was gradually adapted for the event—not that the event modified the organism. It is only necessary to advert to constructive power—which proves, if a proof can be adduced, the constructive intelligence displayed in creation. Chance never could have constructed the wing of a bird, or the hand of a man, and adapted their parts to their particular offices. "The myth of creation" may be erroneously displayed in Genesis; but no doubt it was the collective natural science of the time, mixed with an allegory in its definition.

A pseudo-philosophy assumes that human ingenuity could, in important particulars, improve the living machine. If the sight had the microscopic powers of modern appliances, we should shrink with disgust when food was presented; it would be seen to swarm with animalculæ and their excreta; or if the hearing assumed microphonic proportions, we should be bewildered with sounds, the quiet of nature would be dispelled, and we should be distracted by the whirr of particles and the crash of their collisions; even the growth of vegetation and the passage of atmospheric particles would add to the uproar. We should be conscious of the crash of contending forces and the glare of their phosphorescence; all the pleasures of harmony would be lost; all sense facts be involved in the confusion. If the discriminative powers of touch were enhanced, we should thrill with ever-recurring sensations, crowding and accumulating, by combination so increasing in intensity, that life's repose would be replaced by an agony.[1] The assumed defects are the homogeneity of cause and effect by adaptation. Thus the imperfections of the organs of hearing, sight, and touch become the pleasure of being. Where is the evidence that the exquisite fittedness of phenomena to their purpose is the result of casual amalgamations? Chance in a single sequence might eventuate in orderly arrangement, but in the millions of changes passing around us can it be said the universal unity of action is the result of a chain of accidents? Because we do not see the springs of the energies in the adaptations of causative power, nor how the orderly sequences of phenomenal changes are interlaced by their law, are we, whilst acknowledging the facts of the law to say that there is no superintendence, no law institutor, but that all is an accidental repetition? If there were an inherence of power in every fact, and if the relativeness of each to each were so potent that this relativeness were changed into control, could we even then say that they adapt and amalgamate all other incidents, and impel a homogeneous result? It is admitted on all sides that every organism is actuated in a given direction through its developing power. If all were chance, from whence arises the uniformity? Can we in reason say a chain of accidents is infinitely prolonged and as its result gives orderly arrangement? Are we not compelled to admit if chance were the ruling principle the world would be peopled by the monsters of fable, kingdoms and classes would be confused, and instead of the pleasing facts we know as nature, homogeneity would give place to heterogeneity, and we should be amazed by forms heaped in the wildest confusion? The cause of the life must be ever present, possessing the power to form, to guide, and to govern; herein we must seek that Providence which contrives, arranges, and preserves; but if all this is to be displaced by an "inert" "brute matter," we enquire, whence were the physical forces? Everywhere are seen the acts of the facts; the facts we discern in effects, and although the exact knowledge by which the primordial effect was produced is denied to our research, we know, whatever it be, it was accumulative. This favours the idea that the inciting cause transcendentally exceeds all our ideas, and although always about us, we cannot grasp it, even in conception!

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[1] "Pain is not an evil, but given for benevolent purposes and for some important object" (Bell, *Bridg. Treat.*, p. 155). "The skin is endowed with sensibility to every injurious impression; . . . but had this kind and degree of sensibility been made universal we should have been racked with pain in the common motions of the body, as by the weight of part on part, or the motion of a joint" (*ib.*, p. 157). "Pain is poetically described as that power into whose iron grasp we are consigned to be introduced to a material world" (*ib.*, p. 192).

If growth were what H. Spencer says it is, "a deposit of sediment," then every accidental deposit would be growth, and the dust in the library would be literary growth or enlargement. The book is the physical form of an intellectual symbolism; it and all other forms are objective presentments of an intellectual action so large in character, that the implement and its factor are presented as unity. The "indifferentiated aggregate of protoplasm" is the starting-point of all forms, all possessing powers in unison with their facts.

Small is our world—so small, that our teachers, in their imaginative flights, have compressed the intelligence which pervaded, which fashioned, which governs the Universe into the brainpan of man, or deny it. The buzzing-fly, the growing grass, have mysteries unfathomed, yet water, air, and carbon account for all where method is confounded with principle! We examine the nettle-sting, with its influx and reflux of a subtle fluid; we find the like in the poison-fangs of the viper, but such adaptations in nature become the accidents of physics! We get many assumptions with but few revelations. Darwin by his labours has thrown light on the Kosmic ideas of the old world lore, Babylonish, Phœnician, and Egyptian. We can discard auxiliary or assisting gods, replacing them by elemental substances, and a subtler system of mechanics and chemistry than those divined by man from the lessons of nature; and at length we arrive at the idea of a primæval and existing ALL; thus we get the solution of the Kosmos in Intelligence.

Spontaneity as *generatio æquivoca* has exercised the ingenuity and acumen of physicists in all the ages. At the risk of repetition, it is necessary to explain the meaning attached in these treatises to the word spontaneity. It is never used in the sense of *generatio æquivoca*, but as an exposition of the method of the principle to which is due the coalescing of the elemental particles and of the animate forms—vital action—not as self-induced, but as the result of an energy implanted in the mass in the genesis of a world. Earth, atmosphere, sea, or geology has told her tale untruly, have been modified since the first albuminous spot was condensed in the semi-opaque chaotic mass. The vital energy, increases in vividness of action as the surrounding conditions or environments become adapted to support the more complex living structures; it is therefore urged that the vitality of the genesis is continuous, and spontaneously arises. So far as our finite conceptions extend, there are but two modes by which vitality could be made objective, and to each must be attached every exigency of its condition. *First.* The immediate act of a creator, *i. e. the miraculous.* In this view not a variation could occur, not a mark could be changed, excepting by a direct interposition; and to carry the inferences further, *each individual* of a species would have been fashioned by a direct manipulation. *Second.* A spontaneity arising from vitally indued substances, *i. e.* by the interfusion of the creative energy, by which the germ was endowed with every property needed for its reproduction and differentiation, the jelly speck, the *ovum*, having but the power of nutrition and perpetuation by fission, from which, through adaptations by the vital energy, animate forms eventuated in numberless progressive successions until man was reached.[1] The beginnings of life being always *beginning*, it is needless to enquire whether there was but one germ or many. It is sufficient to say that the forms of life and their environments are in accord, and this is spontaneity, the inrush of life waiting on apposite conditions; then to spontaneity is due "the lordliness of the world." It is not the beginning of life which should be the great difficulty, but the graduations of growth. A world of action must necessarily be a world of vital energy; the vital principle being always present, active or latent (positive or negative), always differentiating, by disintegrations and condensations, ameliorating and preparing. Thus vitality contains within itself the chemical, the magnetic, the mechanical.[1] All we know as creation *may be* a question of physics, or all *may be* an embodied intelligence. *This we can say, there are no phenomena without mechanical arrangement, and that there are no mechanical arrangements without intelligence as designing.* The only possible of a finite reasoning, taking the phenomena of nature as evidences, *is that intelligence is the antecedent of all her facts.* If life be an emanation from matter, in the very baldness of the proposition it is a spontaneous engendering.

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[1] "We have evidence that man has existed for an unknown number of thousands of years on the earth; and that not only is there no trace of any animal rather like man, although of a lower type, but we start with men who, for all we can see, were quite up to the average man of to-day. The skull which of all known skulls is the oldest is 'a fair average human skull.' Research over new areas also shows that civilization has begun and thriven and then faded away in regions where we have no kind of notion of its history. Perhaps the most remarkable instance is that of one of the most remote islands of the Pacific, Easter Island, two thousand miles from South America, two thousand from the Marquesas, and more than one thousand from the Gambia Islands, where there are found hundreds of gigantic stone images, now mostly in ruins. These images are often forty feet high, and have crowns on their heads. The existence of such vast works implies a large population, abundance of food, and an established government. Yet the island is less than Jersey, and was too small tor such a government. The island may probably have been a dependency of a Pacific Empire." Wallace seems indeed to incline for many reasons to the opinion "that the development of the human race has been different altogether

John of Erigena, twelve hundred years ago, repeating the esoteric lore of the Druids, gave as his formula, *There is no life but from antecedent life.* The question assumed a prominence through Harvey, who held life sprung from a primordial germ, egg-like, not necessarily in shape, but in character. Redi expressly held all living matter sprung from pre-existing life, but appears to have doubted his premiss.[2] He held that the living parent gives birth to offspring which pass through the same changes as itself (*Homogenesis*), and also that they give rise to offspring which are different from them (*Heterogenesis*). According to Milne Edwards, *Xenogenesis* has as its division *Biogenesis* (the production of life from pre-existing matter) and *Abiogenesis* (the production of life from non-living matter). Around these propositions the scientific contention rages. If it be conceded that from the egg, germ, or spore comes the living thing, and from the living

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in character from that of animals generally; that the beginning of man was not by the creation of a new form, but by the special sudden change of an old form. What we most realise is that, as to the history of our race, we as yet know very little."—(*Saturday Review*, "Of Tropical Life.")

[1] "The phenomena of life are dependent on neither physical nor chemical causes, but upon vital power; yet they result in all sorts of physical and chemical changes which can only be judged by their own laws." "When we from the phenomena of life enter into the phenomena of the mind, we enter into a region still more profoundly mysterious" (*Lay Ser.*).

[2] Redi, a Florentine (1538), attacked the doctrine of Aristotle, and demonstrated that maggots which appeared in putrid flesh were deposited by flies, yet was inclined to believe that parasites were produced by a modification of the substance of the animal on which they are found.

thing comes the egg, germ, or spore, there is no distinction in principle, but if the latter be conceived in the sense (its usual construction) of the *generatio æquivoca*, then matter is the parent of all living forms. Burdach (1826) introduced the words *Homogenia* and *Heterogenia* as the distinctive modes of the origin of living things. "He did not believe in the creation of a something new, termed life; to him the whole universe, the organism of organisms, was endowed with life."

Pouchet says, "I have always thought that organized beings were animated by forces which are no ways reducible to physical and chemical causes." The postulate of Needham was "special force vegitative." Of Buffon,[1] "the invariable agency of vitality through immaterial *molécules organiques*." Aristotle believed in spontaneity: his illustrations are eels, lice, &c.; Lucretius and Ovid echoed this belief. It was the opinion of the ancient Egyptians that life originated spontaneously. The rallying point of the opposers of spontaneity is the axiom ascribed to Harvey, "*omne vivum ex ovo*," since rendered "*omne vivum ex vivo*." Needham held that if putrefaction did not engender maggots, at least it gave rise to myriads of microscopic animalcules. Spallanzani maintained "the atmosphere bears with it everywhere the germs of infusorial animalculæ, and that Needham had not sufficiently taken this into account." He was supported by Bonnet in the doctrine of Panspermism, and the theory was powerfully advocated by Pasteur and Gleichen; Otho and F. Müller dissented. Treviranus found that the species of animalcules varied with the infusions, which seemed to depend on minute differences. La Mark held that "life was spontaneous," and "that the transitions from life to death and from death to life evidently formed a part of an immense circle of all kinds of changes to which, in course of time, all physical substances are submitted." His conception of spontaneity seems to have had application only to the most simple forms. Cabanis and Oken declared for the possibility of a new evolution of life from dead matter. Oken said the animal body was an edifice of monads, and that putrefaction was their disintegration. Bory St. Vincent, J. Müller, Dujardin, Bremser, Tiedemann, and Burdach entertained a similar view. The three latter went beyond La Mark, and maintained that worms, insects, crustacea, and fish might be produced without ordinary parentage. Pineau (1845) declared he had seen the origin and development of ciliated infusoria, the *Monaslens* and *Vorticella*, and of a fungus, *Penicillium glaucum.* Something of this character appears to have been witnessed by Dallinger and Drysdale. Gervais, Schwann, Schultze, and Ehrenberg were panspermists. Milne Edwards attacked the theory of Pouchet, as did also Quatrefages, Claude Bernard, Dumas, Payen, Lecaze, Duthiers. Mantegazza adduced new matter, agreeing with Pouchet; Pasteur affirmed the opposite, and continued the controversy with Pouchet, Jolly, and Musset. In 1862 Jefferies Wyman, and in 1868 Cantoni, adduced evidence which seemed to show the possibility of living things being produced from non-living matter, as did Bastian in 1876.

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[1] "Perhaps there are many living things, both animal and vegetable, produced by a fortuitous aggregation of the *molécules organiques* as there are others which reproduce themselves by a constant succession of generations" (Buffon).

Tyndall conceived, from the results of experiments by Schwann and others, "that the power of scattering light and the power of producing life would be found to go hand in hand." He entered into a series of experiments, and came to the conclusion that life can alone be produced from antecedent life ("Dust and Disease," *Frag. Sci.*).

Here we meet the difficulty; Does the antecedent mean the individual fact or life as the vitality of a collective whole? If of an individual fact, whence was its initiation? if a collective vitality, then life must be always spontaneously occurring, *a continuing beginning.*

The experiments of Tyndall are interesting and his contrivances ingenious, but, as others do, he first destroyed and excluded all possibilities of life and then assumes that he presents the facts of Nature: Nature prepares her conditions, and life appears. Were the land rendered sterile would the corn grow?[1]

Schultze and Schwann passed air through heated tubes or through strong sulphuric acid, and no life appeared, but if the same infusion was afterwards freely exposed to the air, life was found to be abundant. Contemporaneously La Tour showed that yeast is composed of a vast accumulation of minute plants, Torulæ. Berzelius, and Liebig denied the premiss; Huxley upheld and proved it. Helmholtz "separated a putrefying or a fermenting liquid from one which was simply putrescible or fermentible by a membrane which allowed fluids to pass through," but not solids, and he found those substances "neither putrefied nor fermented;" hence the assumption that the life-bearer was a solid. Pasteur's experiments were exhaustive. Innoculation has the same effect as a free contact with the air; the floating germs are so small that they are imperceptible. The *vibriones* and *bacteria* are so subtle that they can live without air or free oxygen. The grubs in galls have been detected by Valisnieri, Réaumur, and others, and are proved to be no products of the plants, but of the eggs of insects. Von Siebold, Leukart, and Kuchenmeister have shown that tape and bladder worms have been traced to an egg. Chauveau (his theory is confirmed by Burdon Sanderson) has shown that in vaccine matter the solid particle (*microzymes*) is the living principle, the liquid in which it floats and at the expense of which it lives being altogether passive. The question then arose, were the microzymes the result of homogenesis or xenogenesis, or were they capable, like the torula, of arising only by the development of pre-existing germs, or were they parasites, or what Virchow calls "heterologous" growths? A parasite may be stamped out by destroying the germs, but a pathological product can alone be annihilated by removing the conditions which gave rise to it. It appears proved that certain diseases of plants and animals are caused by *minute fungoid* growths—as the smut in wheat, the grape disease (Phyloxera), the spore-forming filaments and the febrine in-silk worms, which Lébert studied and named "*Panhistophon.*" The infections haunting hospitals, and which often render futile the most successful operations, are probably also of fungoid origin. Mayer held the life processes in living organisms are produced by forces acting from without, and are the immediate sources of those modes of force apparently generated in the organisms. Neupert held light to be the primary source of all vital and constructive power. Downes and Blunt, in a series of elaborate experiments, show that oxygen and light in some cases were positive preventives to the appearance of life.

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[1] All that has been done shows that when non-natural conditions are imposed life does not ensue. A fecundated egg receiving its due complement of warmth, a chick appears; boil the egg, or deprive it of the warmth, no life follows. If life be the law of nature it is a recurring law, a continuous fact always originating. If it be not so it is an absurdity to talk of law, for we then should have only what is called miraculous interposition, and science would be an impossibility.

Carpenter says, "Vital forces bear the same relation to the physical forces as they bear to each other, the essential modifications being effected by their passage through the germ of organic structure, in the same fashion as heat becomes electricity when passed through certain mixtures of metals; so close a mutual relationship exists between all vital forces, that they may legitimately be regarded as modes of one and the same force." He further says, "Vital force, which causes the primordial cell to multiply and then develop itself into a complex and extensive organism, was not originally locked up in that simple cell, nor was it latent in the materials which are progressively assimilated by itself and its descendants, but it is directly and immediately supplied by the heat which is constantly operating upon it, and which is transformed into vital force by its passage through the organized fabric which manifests it." "All the forces which are operating in producing the phenomena of life are, in the first place, derived from the inorganic universe, and are finally restored to it again." "All that has been expended in building up the organism is given back by its decay after death" (*Begin. of Life*, *Phil. Trans.* 1850).

There are two generalizations of life: vitality, regarded as the principle and the cause of organization, and organization regarded as the principle and cause of life. The material school regard the latter proposition as the true one. Anaxagoras held that flux and reflux or mutation was the principle of organization, but acknowledged a motor—the *nous*, the animating soul imminent in all living things. . . . This doctrine is assumed to be Pantheism, the soul of the world split into a thousand mystic elements, and becoming objective through the vitality observed in nature. The futility of all attempts to manipulate life should be accepted as the expression and fact that vitality is something more than mere chemical combination and the mechanical expression of force. When the creature thrust itself into being, as in Dallinger's observation, it was, so to speak, an accidental aggregation of inorganic stuff emerging into life. But what does this prove? Merely a reversion to a primordial fact, the simplest form of life presented from the inorganic, a free-swimming infusoria, the *protamœbæ primitiva*, *protista*. Life is not so much the question as its derivation. The minutest possibilities have to law the same relations as has a universe. In the simplest apparatus of animated motion the cilia are present; the same are found in the complex mechanism of the heart. The immense reality of nature causes its principles to be unrealized; to reject the antecedent cause is only to increase the difficulty, and removes us into an unconditioned or an unthinking past; the same fact still confronts us—*we are never rid of the antecedent of the life.*

Where in the whole range of phenomena is there a fact without mystery, and where is the fact, with its thousand incidents, which ever has been thoroughly explained? The divisions of the egg are regarded as a mystery. The cohesion of the waterdrop is the perfect counterpart of the generating sperm. The waterdrop divided, it is still a drop; roll the particles together, it is still a drop; the division and the unity are equal mysteries, and yet are the universal facts of nature. We see the division without crack or break; we see the union, but there is no trace of the fusion. We attempt to solve the beginnings and origins of life; we fail in the outset. We see bodies imperceptibly melt one into the other, and there our knowledge ceases. Principles are assumed to be known by results; constancy of result is called the law; we trace the action to a particular point, and the vision abruptly ends. With all the boasted progress of science, not an ultimate is explained; and were we, with Tyndall, "to pass the bounds of experimental evidence," we should find vital and immortal mind as the fact of being, and matter would be relegated to its real place—that of use.

Bence Jones says, "Inorganic matter and inorganic force always exist together in living things, so that if a separable living force be also present, then we must admit two totally different laws of force must be in action at the same time and in the same matter." Is it not possible that the principle (although continuously existing) is merged in the method? Bastian says "the mere advancement of such a proposition (the existence of vital force) would seem to show that the promulgators of it had not seized the very elements of the doctrine of the persistence of force." What are the corpuscules of the blood but the results of vital action? Force can split substances into myriads of fragments; it does not generate; there are no fragments in the blood-corpuscules; by their combination, is produced the necessary substance of life the egg or nucleus enveloped in its matrix. Goodsir held "it was not the cells but the nuclei of the textures (the germinal spot of the ovum) which contains the potence, and should be called the centre of nutrition."

To say with Lewes, that life is the result of organization, is saying vitality is a consequent of matter. Vitality is always connected with a substance, but this is far from proving "that life is only a generalised expression, signifying the sum total of the properties of matter possessing such an organization." We might just as well say the waggon draws the horses. It is not the word, but its significance of meaning we are to regard. Words should be, as they were intended to be, the symbols or expressions of facts and ideas.[1] The facts of phenomena show vitality to be a thing *per se*. Spencer has also a refinement: "Life is a mere name, consisting in a set of attributes which belong to all living things." The persistence and consistence of matter as a thing *per se* is an illusion; the hardest rock may be represented by a floating vapour reflecting the summer sun light. And in the consonance of facts, *in invito*, I say in respect to the axiom, *ex nihilo nihil fit*, if intelligence is found to be the basis of phenomena, force also is shown to be an exemplification of will, and as intelligence is acting and substantial, although imperceptible, it may represent the *ex nihilo* of the axiom. (*Vide note* 1, p. 190.)

Graham held there is a radical distinction between complex nitrogenous forms, "colloids" (gelatines may be taken as their type) and crystalloids, as regards their molecular constitution, and also by the gelatinous character of their hydrates. Yet in geological periods they appear to have passed into crystall~~oid~~ forms, as ine sponges into flints. Haeckel says, "The origin of life on our globe has at present become a logical postulate of scientific natural history." The lowest forms of vital manifestation appear in simple jelly-specks, the *protamœbæ* (*ib.*). Owen says the rotifers, the *vibrio* and (such) others, exhibit a great tenacity of life, and will remain as if they were completely lifeless for many years; moisture restores their faculties. On the other hand, there are forms remarkable for the opposite characteristic; others may be cut into many pieces and still live, and are reconstructed from the parts, each part forming a living animal. The *hydra viridis* and the *medusa* afford examples. Speaking of the *monera*, Haeckel says "the albuminous-like gelatinous matter is presented as the material stratum of the life phenomenon," "organisms without organs possessing the functions of nourishment, growth, and reproduction." The tenacity of life exhibited in some of the lower forms is repeated in plant seeds. Some corn taken from a tomb in Egypt is reported to have germinated after a lapse of three thousand years. A bulb was exhibited before the Linnean Society taken from the hand of a mummy; it grew and flowered.

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[1] Huxley, speaking of criticism, says—"It is essential to anybody's being able to benefit by criticism, that the critic should know what he is talking about, and be in the position to form a mental image of the facts symbolised by the words he uses" (*Nat.*, Jan. 11, p. 221).

According to Dumas and Bousingault, "Plants in their natural and healthy state incessantly decompose carbonic acid, fixing its carbon and setting free the oxygen. Nitrogen is extracted directly from the atmosphere, or indirectly from the nitrate of ammonia which has formed there. Thus plants become chemical agents, the heat and light of the sun being the moving principle. The carbonic acid, the water, and the nitrate of ammonia are decomposed because the carbon, the hydrogen, and nitrogen unite with the oxygen to produce the substance entering into their composition. In animal organisms it may be said to be burnt in the performance of the animal functions, and returned to the air in the shape of carbonic acid. Hydrogen burnt is returned as water; nitrogen is exhaled and thrown off in different excretions." Dumas says, "Carbonic acid, watery vapour, and azote, or oxide of ammonium, are continually escaping (simple substances, few in number, connected with the history of the atmosphere), which plants are continually needing and continually extracting from the air;" "they are the true laboratory; carbon, hydrogen, and ammonium and water are the elements they work upon. Woody fibres, starch, gums, sugars are the result, whilst fibrine, albumen, casein, and gluten are the products which present themselves in either organic kingdom."

Tissue elements, as epithelial cells, are, to an extent, like distinct organisms, and have a definite life of their own, as shown by the power they possess of selecting their particular nutriment. Schleidan and Schwann (1839) endeavoured to prove that the tissues of plants and animals are entirely built up of cells, and are continually produced *de novo* from a structureless substance, sometimes fluid, at others more or less gelatinous, arising from chemical qualities or degrees of vitality. The nucleus (generally) appears first, then the cells around it, and it has the same relation to organic nature as crystallization has to the inorganic; the cell once formed continually grows by an inherent power, but is governed by the entire organism. It is the same in principle whether the cells are formed by the parent cells, or whether the formation goes on outside of them, and whether it takes place in a fluid or in a structureless substance—the cell-germinating material (*cytoblastema*). The cells might remain isolated, or by the development or by the coalescing of their walls produce the textures of plants and animals. Thus all tissues being made up of cells, the nutrition and growth reside in the cells. Goodsir says the whole are divided into departments, each containing a number of developed cells, which are in relation to one central or capital cell, from which all the other cells of its department derive their origin. These eells are of two kinds, textural and organic, the nutritive centres being generally permanent. Analogically considered, a cell is the source of a brood of young cells.

Virchow held "the cell is really the ultimate morphological unit in which there is any manifestation of life, and we must not transfer the seat of real action to any point beyond the cell." He denied Schleidan's theory of cells *de novo* in the *cytoblastema*, and contended they could only be produced from pre-existing cells, and whilst admitting a large amount of intercellular matter, thought it might be broken up into cells ruled over by one central cell, *i.e.* every animal presents itself as a sum of vital unities—an aggregation of minute dependencies. Nägeli, Braun, and Max Shultze held the cell-wall was not an essential character, Brüke and Kühne that the nucleus was not an essential constituent of the body, thus reducing the whole to a non-nucleated bit of protoplasm as the simplest substratum for the display of vital manifestation. Reichert and Du Bois Reymond (1861) held that a mass of protoplasm with a nucleus was sufficient to constitute a cell, but maintained that the substance of the cell (within the walls) was protoplasm, called by Dujardin *sarcode*, a solid globule containing a nucleus. Bastian contends "the mass of protoplasm containing the nucleus cannot be regarded as the ultimate vital unit," because it is acknowledged a cell, may or may not be enclosed in cell walls. Beale, whilst admitting a morphological unit, which other observers have found to enter largely into the formation of the tissues, denies that anything in the ordinary definition of a cell would apply or could be said to constitute the parts of many tissues. "The cell or elementary part" is a structure "always consisting of matter in two states, forming and formed, or organized matter and formed material." The first is protected by outer passive matter, through which the pabulum passes to be converted into germinal matter. With this view Bastian does not agree, because "many of the most characteristically vital phenomena of the highest animals" take place "through the agency of tissues, muscles, and nerves," which, according to this view, "would have to be considered dead and inert." He says it is "a singularly foundationless hypothesis, for it must be dead or living, animate or inanimate."

Following in the main Woolf and Von Baer, Huxley holds "the primitive organic structure is a homogeneous plasma, in which certain differences take place, but that there is no evidence to show that the molecular forces of this living matter (vital forces) are by these differences located in any particular part, be it cell or intercellular tissue, nor is there any evidence of the influence exerted by one over the other, but that each proceeds in accordance with the general determining law of organization;" "that primary differentiation is not a necessary preliminary to further organization; that cells are not machines, by which alone further development can take place (*Rep. Brit. Ass.* 1855). Bennett—"*First.* In the process of organic formation is the production of an organic fluid. *Second.* The precipitation into it of organic molecules, from which, according to the molecular law of growth, all other textures are derived, directly or indirectly." "The ultimate parts of organisms are not cells or nuclei, but the minute molecules from which these are formed," possessing "independent physical and vital properties, which enable them to unite and arrange themselves so as to produce higher forms."

Bastian says, "The organic fluids pertaining to higher animals and plants can only be said to live because they constitute parts of living organisms." After the chyme had been converted into chyle, he demands, does it become a living fluid? In some stage "the passage from the not living to the living must be effected, and the process is probably not more abrupt than that reverse process by which living matter again reverts to not living materials, such as are cast off in various excreted fluids." "When the molecules aggregate so as to form the smallest conceivable streaks of protoplasm, then does nascent pass into potential life." "So in each act of growth non-living matter must be converted into matter which lives."

Rainy, by his investigation of crystalline forms, has shown that the formation of crystals and living things is essentially the same in kind. *Plastide* particles and *bacteria* we know something of, but of invisible organizations we know as little as we do of the invisible germs of crystals. Without the unit of life both are hypothetical assumptions. From the examples adduced, spontaneity appears to be the fact of nature. Accept Rainy's experiments as proofs, and there is no distinction in the principle of formation between organic and inorganic substances, and we fall back on the axioms, *Omne vivum ex ovo* and *Omne vivum ex vivo.* Each has its truth—the first in spontaneous action, the latter in the continuing fact.

Man interfuses his intelligence into his work, and so we may conceive the Creative Intelligence by which the phenomena of the Universe was directed, interfused its vitality into its work, thus making the universe through this vital energy an organic whole; vital in the particle, vital in their coalescence. The demand of a rigid proof of the advent of life is the demand of an impossibility, because no man ever saw the transposition of inorganic substance into living substance—yet all the facts of nature show the inorganic is always becoming the organic, and animated organic substances are always becoming the inorganic. Whatever may be the reasons to be derived from phenomena in support of a for-ever recurring spontaneity, they are futile so long as the hypothesis that atmospheric invisible germs are living organisms exists every reason adduced being met by these invisible motes. New forms of disease are said to appear. If there be such, the elemental substances inducing the morbid action have existed since the dawn of creation, probably not the particular combination, or the disease would not have been new. We must conceive that the Creative impulse is always creating and always producing. Palæontology discloses this to be the fact of the geological eras; new forms were always intervening. In these days either the hypothesis of Evolution is all nonsense, and Darwin has made unsupported assertions, or we witness variations and changes, and those of sufficient importance to be classed as new species. All changes are infinitesimal, but all changes must have an initiation. Prolong a dot, we get a line; join the ends of a line, we get a circle; press the circle in particular directions, and we get diverse figures, mathematical when the pressure is methodically directed. Thus as the dot is the initiation of our illustration, so vitality, infinitesimally and continuously prolonged, is the initiation of nature, and in a resulting spontaneity of her forces we find phenomena.

CHAP. V.

MIND. VITAL ACTION.

WHEN we attempt to classify the facts of mind we get *I think*, and I think, asserts its independence of matter by asserting control and command. Berkeley said matter is substance which has extension, spirit is substance which thinks, but has no extension. Huxley, discussing Descartes, says "the soul is a mathematical point, having place but not extension;" not only has it place but it must exert force, for, according to the hypothesis, it is competent when it wills "to change the course of the animal spirits, which consist of matter in motion." Thus the soul becomes a centre of force; but he says, "At the same time, the distinction between matter and spirit vanishes." Elsewhere he says, "A really spontaneous act, which by the assumption has no cause, and the attempt to prove such a negative on the face of matter is absurd, and while thus it is a philosophical impossibility to demonstrate that any given phenomenon is not the effect of a material cause, anyone who is at all acquainted with science will admit that its progress in all ages meant, and now more than ever means, the extension of what we call matter and causation, and the concomitant gradual banishment from all regions of human thought of what we call spirit and spontaneity."

If the soul can *change* the course of the animal spirits, despite the dictum that no phenomenon can be demonstrated to be the effect of other than a material cause, *it has control. Thinking matter* would never *cause* that which dominated it. The exigency of the new philosophy may demand the banishment of "spirit and spontaneity" from all regions of human thought, but it has yet to be proved that matter itself has any existence apart from *perceptive consciousness;* and also it has to be proved that *all phenomena are the effect of material causes.* In such utterances there is a confusion of cause and effect, of perception and conception. To comprehend material phenomena sense must be balanced by sense, and then we only arrive at a sensory or perceptive fact. When we arrive at intelligence, however instituted, call it spirit, mind, or soul, a distinction is established: *there is no form presented, but intelligence moulds it.* Matter cannot be higher than itself. We have matter and the moulder, therefore we should say, using the same dogmatic view, it would be absurd to attempt the proof of a *material cause in the face of intelligence.* It *may be* the expression of *scientific ignorance* to hold *that a thing and the cause are distinct,* but it is a philosophical impossibility to confound the two. It *may be* that causation does not mean "the act of causing or producing," and that "scientific imagination" and scientific nomenclature may assign to "matter and causation" another meaning than the effect and the cause of it. If matter and causation be one, it is illogical to deny spontaneity and accept the potence of matter; in such a phase of thought it should excite no astonishment did an Adam emerge from the rock.

Roget, in other words, says the region of thought merges in spirit. Heinrich Heine, speaking of Spinoza, says,[1] "In his writings one feels a breath which moves one in an indescribable way, as though one was breathing the air of the future." Helmholtz, commenting on Kant's idea of "thinking again the thoughts of the Creator," says, "If this principle can be extended to the moral sciences, it is equally operative as to physical facts and to the Hegelian philosophy." "That in the moral sciences traces of the activity of the human intellect and of the several stages of its development should present themselves is a matter of course; but surely if nature really reflected the result of the thought of the creative mind, the system ought, without difficulty, to find a place for her simple phenomena and processes." If, according to the hypothesis of Kant, we can take the thought of man as the reflex action of the creative mind, we can view in man that emphasis in nature where phenomenal mind finds its expression, by the law of development, as spirit. Manning says we have the same evidence of the existence of this self-determinating power within ourselves as we have of a material world outside ourselves.

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[1] Spinoza entered into the views of Descartes. Being a Jew, and doubting the authority of the Talmud, he was subjected to persecution by his co-religionists. His attempt was "to deduce the fundamental principles of moral life by strictly mathematical demonstrations founded on the knowledge of God," which led him into the theory also proposed by Descartes, "which asserts the existence of only one absolute essence, Deity." "Infinite being with infinite attributes of extension and thought, reducing all finite things to a state of apparent substances and limitations, or *modi* of those attributes. Substance is not individualised in being, but is the foundation and substratum of all individual beings; it exists *per se* and of necessity, and can only be thought by itself. Nothing can be said to have a beginning but finite objects." "From the attribute of Infinite extension arises the modifications of motion and repose; from that of Infinite thought, those of the understanding and will." "All finite things (*e. g.* body and soul) exist in the Deity, being their immanent cause (*natura naturans*). He is not finite, but from Him all things have proceeded," and He "operates according to the internal necessity of His own nature; His will and knowledge are inseparable." He postulates that "every idea of a real object embraces at the same time the Eternal and Infinite essence of God; the knowledge of the Infinite and Eternal essence which every idea embraces in itself is adequate and complete. The human understanding can, therefore, adequately apprehend the nature of God." He assumes substance and causality to be self-evident. Tennemann says, "Grant the premises and the mathematical edifice is complete. It has been called Atheism from the passions of the disputants, rather than from anything contained in the theory itself. It is rather a system of Pantheism, not material, but formal," and "illustrates the most exalted idea of the Divinity as the original *Esse*" (*Tennemann*, by Morel).

The Chinese philosopher Lao-tse had a high conception of spirit;[1] and Togan, one of the oldest of the Welsh bards, said, "Where God is silent it is not wise to speak."

> "The unknowable is . . . the hidden source from which both the great streams of being, internal and external, take their rise. Since then our minds originate in that universal source; since it comprehends every form of existence within itself, we stand to it in relation of parts to a whole, in which and by which those parts subsist. There is thus not only likeness but identity of nature between ourselves and our unknown origin" (*Anal. of Rel. Bel.* ii, p. 463).

When we think our *own* facts, whatever the soul may be, whether of the world or of individuals, it is spirit, and sets matter in motion, not as particled with it, but as its director. Huxley, speaking of Descartes' discourses on method, says we arrive at two paths open to us, the Materialistic[2] and the Idealistic. Whatever the philosophy of Descartes pointed to, he believed in the existence of a god as separable and distinct, as an infinite projection into a finite receptacle.[3] Had the idea of God been

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[1] Lao-tse says, "Taò, if it can be named, is not the eternal name. The nameless one is the foundation of Heaven and Earth. He who has a name is the mother of all things. He who begins to create has a name." He further describes the unfathomable Taò—"It strives not, yet is able to overcome. It speaks not, yet is able to obtain an answer. It summonses not, yet men come to it of their own accord. Is long suffering, yet is able to succeed in its designs."

[2] Webster defines materialism to be "the tendency to give undue importance to material interests; devotion to material nature and its wants;" a materialist, "as one who denies the existence of spiritual substances, and maintains that the soul of man is the result of a particular organization of matter in the body."

[3] Descartes says, "One thing in the midst of my universal doubt is certain, viz. that I do really doubt and think, and that therefore I do really exist. Admitting the

"*repugnant*" to Goethe, we should never have had his beautiful idealization as rendered by Carlyle:

"In Being's floods, in Action's storm,
I walk and work, above, beneath;
Work and weave in endless motion!
Birth and death,
An Infinite ocean;
A seizing and giving
The fire of living:
'Tis thus at the roaring loom of time I ply,
And weave for God the garment thou seest Him by."—*Faust.*

Or, as it has been also expressed, "*the living and visible garment of God.*"

In the attempt to bridge the gulf between "matter and causation," vitality is reduced to molecular vibratory action. The *vis viva* of science, *i. e.* the product of the mass of the moving body, is due to an interior energy. Is it a cause or an effect? The underlying energy of vital force collects and agglomerates "matter" into determinate forms. The sun, so far as our system is concerned, is the great storehouse of energy, of an energy as expressed in the correlated forces, whereby physics become a chain of effects tending to an ultimate. Given the sun is the source and maintainer of all terrestrial life, we are no nearer a solution of the mystery of life. If the sun be the impulser, what impulses the sun? which Herschell demonstrated to be one of the twinkling specks of light in the plane of the milky way. If the sun be travelling with his train of satellites around another sun, upon the principle that the sun is the terrestrial renovator, the sun of the sun must be its renovator, all things being dependent upon their centres of attraction; we then fall into a train of suns with their

existence of a powerful being bent on deceiving me, yet I feel I must exist in order to be deceived. When I think that I exist, the very act of thinking proves that I really exist. The proposition I am, I exist, is always necessarily true whenever I express, or think it, *cogito, ergo sum*. Ideas through which I think of substances are more perfect than those which present only modes and accidents. The idea of an Infinite, Eternal, Unchangeable, Omniscient, Omnipotent, the Creator of all finite things, has more ideal reality than the ideas which represent finite substances. But there can be no more reality in an effect than in a complete cause; cause must contain either *formaliter* or *eminenter*, all that is real in effect (*i. e.* the same realities, or others superior to them); therefore, if the representative reality of any one of my ideas is so great that it exceeds the measure of my own reality, I can conclude that I am not the only thing existing, but there must be something existing which is the cause of that idea. Since I am finite, the idea of an Infinite substance could not be in me if this idea did not come from a really existing Infinite substance. I may not regard the Infinite as a mere negation of finiteness, like rest and darkness. I myself, who have the idea of God, could not exist without God. I owe my existence to others (parents), yet there must be a first cause, which is God. My continual existence from one instant to another cannot depend on myself, nor on the finite causes of my existence, but only on the first cause. The idea of God is in the same way innate in me, as is the idea which I have of myself."

attendant spheres, cycles within cycles; then in the millions of suns which throng space, where among them are we to seek the life giver? We may reason on the fact only to become bewildered in an unthinkable stratum of creative impulsions. We have firmaments beyond firmaments, and all are segments of circling zones due to the primordial energy, universal pulsations in the throes of an unceasing vitality. Particle depends on particle, systems on their suns, suns on their systems of suns, all the children of heat as the ultimate unit of objective forms.

Science demands the cognition of universal law and attempts to demonstrate that organism and mind are its exemplification; nature is an aggregation of particles, and yet, notwithstanding, is an organic whole. "Spirit and matter have been looked on in rudest contrasts, the one all noble, the other all vile," because indiscriminating reasoners confound perception and conception. The perceptive philosopher "quietly believes this universe to be a great unintelligible perhaps." If this be true, "there is no religion, there is no God; man has lost his soul, and vainly seeks anti-septic salt." "Certainly any society setting out with this no-god hypothesis will arrive at a result or two (*Past and Present*). Man is the concentration of two principles co-ordinated in his nature, "the nerves of the body are so many strings differently attuned, which respond to universal power;" the chords are felt, and connect "the phenomena of the visible with those of the invisible world." We feel our finiteness when we collate our knowledge, and are mute with astonishment when beneath phenomenal facts we find an intelligence which we are unable to grasp.[1] The primæval egg is alone like itself, but in its issue no two individuals exactly agree; the distinctions are "the results of infinitesimal quantities moving through practically infinite time," "exacting from every antecedent its equivalent consequent, and from every consequent its equivalent antecedent." The theory of development overthrows the dogma of separate creations, assigning as its outbirth an imperishable law.

Kant and Laplace arrived at the conclusion that the bodies which stud "the univercœlum" "once formed an indislocated mass." The hypothesis is said to be confirmed by the spectral analysis, painting as it does each constituent element in its distinctive line. If the theory of evolution be fact, this Kosmic mass contained the germs of all things: "the Spirit of God moved upon the face of the waters." What was this Spirit? what this presentment, but the breath of life expanding in creation? filling the void with vitalized substances, whereby the purposes of the creative energy were effected, thus bringing its facts before the bar of judgment. If creation be mere "scientific imagination," it will remain an hypothesis, but if founded on truth and confirmed in reason it will be stable as eternity. Development is the bond-link of continuity, transporting "the conception of life's origin to an indefinite past." Evolutionists cannot conceive in nature the impossible; they do not attempt to solve the ultimate mystery of the universe, they only make the possible probable. Their business is not with a worldwhich might be, but with a world which is, and they attempt "by means of the tangible processes of nature to apprehend the intangible." "Let there be light," and ultimate substance was particled. In the ether is light—however luminous the beam, "it remains invisible unless it has something to shine upon." If its constituent be heat, in the heat as concentrated in the ether we behold the womb of phenomena.

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[1] "We should be searchers for truth rather than seekers for eclat, and each of us should think of himself, not as a man seeking to gratify his own thirst for knowledge, or to promote his own private advantage, or to shine by his own abilities, but . . . as fellow-labourers in one great common work bearing upon the highest interest of humanity" (Helmholtz).

The uncultivated mind sees in the beneficence of nature the action of a good spirit, the semicultured mind regards the unseen with dread, but the highly cultured mind finding everywhere in nature the universal principle of harmony associated with power, conceives a ruling principle. Some postulate nature as the embodied thought of this principle, others see but the directing law, and pronounce its originator unfathomable. Others go beyond, and accept nature as the effect of God's action, and believe He is present in His law. There is still a beyond in the postulate of a God, which assumes to know both His form and His thought, and explains all by an incomprehensible dogma. What is its fact, who shall say? There is no surplusage for man. The fact of mind shows a purposeness in the fact man. "Nature's laws are eternal; her small still voice, speaking from the inmost heart of us, shall not under terrible penalties be disregarded." "Nature has appointed happy fields, victorious laurel crowns, but only to the brave and the true; un-nature—what we call chaos—holds nothing in it but vacuities, devouring gulfs" (Carlyle). Superstitions may be bred from the wonders of natural phenomena, but a calm contemplation of the facts shows bases beyond the things of sense.[1] As in savage man we find the moral power of judgment, its basis must be the conceptive faculty. If we assume for them degeneracy of race we must still assume the sentiments were existing; the fear of the unseen then has its seat in the ideal. If they stand but in a natural supremacy we must still assume such ideas are innate, because universal. We may assign the provisions of organic life to "heredity;" are we to descend to the insect to illustrate the power of illimitable intelligence? In the bee, the ant, and the spider we have a prevision which transcends the intelligence of man; culture could give nothing to them; but culture and culture only can uplift savage man so high that in mental calibre he might rank with the highest human intelligence. To what end, we ask, was the institution of the abstract powers of mind, if its purpose was not for an elevation of being? Science leads to an inference that the first corpuscule which burst into a vital and sensitive organism carried with it the germ of mind. Why? Sensation alone would satisfy the organic facts of life. The general fallacy of theories is that they prove too much; it was this which laid Berkeley open to the suspicion of materialism, and subjected Butler to the charge of having been "*forced* to admit" the immortality of animals.

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[1] "No doubt from the first there were certain phenomena which to the savage mind presented a constancy of occurrence, and suggested that a fixed order ruled, at any rate, among them. I doubt if the grand fetish worshippers ever imagined that a stone must have a god within it to make it fall, or that a fruit had a god within it to make it sweet." "The little light of awakened human intelligence shines so mere a speck amid the abyss of the unknown and unknowable; seems so insufficient

Where, in the teachings of the science of the day, do we find a verification of the observation that "the vocation of the experimentalist may be described as the continual exercise of spiritual insight, and its incessant correlation and realization aided by mathematics and intelligent induction?" This should be the method of science; but when on the one hand the existence of spirit is denied, and on the other it is assumed that all things are of matter; in such phases of thought, vitality and mind become unknown quantities: yet they are the only indurate truths of existence.[1] If such assumptions were the true facts of nature we could not say with Fichte "that there was a structural energy ready to come into play and build the ultimate particles of matter into definite shapes." Take from phenomena vital cohesion and we solve the problem of Biela's comet. The world is a mite amid

to do more than illuminate the imperfections which cannot be remedied, the aspirations which cannot be realised of man's own nature. But in this sadness, this consciousness of the limitation of man, this sense of an open secret which he cannot penetrate, lies the essence of all religion" (*Essays and Reviews*, Huxley).

[1] To assume that there was a beginning is said to be a denial of the idea of Eternity. Possibly our conception of eternity is a misnomer, and that each thing has an eternity consisting in its own cycle. We cannot conceive *a was* before consciousness; yet if consciousness has *states* there may be many eternities. If the beginning were of matter, all things were inert; if of force, it had an antecedent in heat; if of heat without direction, it would be an incandescence; if of intellect concentrated in consciousness, such could be conceivable, and by such a connection we might say the universe is the embodied thought of a boundless intelligence, or with D'Alembert, "the universe is but a single fact comprised in one truth."

the roaring reality of the spheres: we are chained to this orb, where the finite clings to the finite, and in a finite perception, the *all of all* is pronounced to be contained in its substance. The vitality of the world is an epitome of the vitality of the universe, and in its increment, spirit, we comprehend in the universal the vital energy of the "uncaused cause." All this vanishes: we are told, "when we are hurt the brain feels it, when we ponder the brain thinks." How insignificant are the results of science whilst the problems of vitality and mind are unsolved. Bacon made collected experiences the bases of knowledge; and when Descartes said, I think, he saw phenomena were guided by mind. In consciousness the perceptions of phenomena are collected; whatever vitality and whatever mind may be, *by the possession of them as conscious facts* we know that they are. What are *Egos* and non *Egos?* schoolmen's expressions; phrases to catch the unthinking. We are told matter is an existing thing, because water, when rendered diamagnetically polar, will twist a ray of light perfectly determinate, both as to quantity and direction. In water forces are in equilibrium; the distortion of the light ray is due to its being hustled too and fro by the imprisoned heat. Dissolve water into its constituents, it is viewless as the blast. A dissolved material is unseen in the ray of an electric lamp aided by all the powers of the microscope; it has disappeared, resolved into its matrix, for did it exist in its particled proportion, it would scatter the light ray and thereby be rendered visible.

In visceral effects we have vitality without sensation; and there are creatures so low in the scale of being, that the functions of nutrition are effected alone by absorption and exhalation. Plants are susceptible of irritation and prostration; hence they have vitality and it is said a nervous system. There probably are, as Lewes says, systems of sensations; but wherever we find sensation, we have vitality, the energizing utilizer, and the manifestation of an ultimate particle; for Force must be "regarded as the disturbance of an equilibrium to which all things tended before its exertion, and to which all tend after its cessation" (Huxley). From impulse it comes, and friction, however inverse the effect, but for friction nothing would be stable; a blow from a handkerchief would set a heavy object spinning, as vertical force (gravitation) does not interact against a horizontal force; and the wind sweeping the earth, but for the friction of the interacting particles (*inertiæ*), and through their resistance, would assume such proportions, that all things would be prostrate before it (Arnott).

Newton supposed light to consist of small particles shot from out luminous bodies, with inconceivable velocities, fine enough to pass through transparent media. The experiments of Fizeau and Foucault proved that light was not a propagation from matter, but the propagation of an energy in wave motions. Huggins demonstrated that if light were wave motion, its velocity in a dense body must be less than in a rare medium. Fizeau and Foucault proved its velocity was less in water than in air. Euler was of the same opinion as Huggins: La Place, Malus, Biot, Brewster, and Bell agreed with Newton. The undulatory theory of light is that now accepted by science. Sound also is an undulation depending on the relations of the elasticity to the density of the body which transmits it. In considering the action of light, the facts disclosed when Tyndall was experimenting on spontaneity, appear significant. He found the luminous beam from his lamp was visible up to his apparatus and beyond it, but not inside of it: hence the undulation must have passed through the glass, the air and the glass, and was reflected by the floating motes beyond; the substances were penetrated and the beams were undistorted. The facts are exactly those to be expected from Newton's theory. Is it not possible the theories are the same, but varied by conditions?

Consciousness would not be consciousness, unless in itself were comprehended all sensations, perceptions, and conceptions. Mind may be said to be the psychic action of existence, as sensation may be said to be the effective vitality of organic forms. Each is particled, *vide* p. 9, yet in consciousness they are but one state. We may trace in sequence sensation to mind; but the process ceases when ideas become thoughts. Thought can exist without sensation. Thought is particled into ideas, yet thought is but an idea; an idea cannot be said to be thought, because thought insists in reflection, thus ideas are the particles by which thought is engendered. Ideas are presented in the mind as conscious facts, and also without a conscious act; whilst the perception exists only in idea, it is crude and uninformed. By consolidation in reflection, ideas become mental facts in consciousness; thought then comprehends sensation, and through sensation acquires vitality. Vitality in organic life precedes sensation. We have vitality without sensation, but never sensation without vitality. The contraction of the muscles, the opening of the eyes and mouth in a severed head, is not sensation, or even an expiring vitality, it is a merely mechanical or electrical contraction; and of this character are the convulsions of a frog, when the dead creature is touched by the voltaic conductor. Perhaps a greater proof could not be produced of the true nature of the nervous system than such an exhibition, making it clear that the action is a consequence of a something acting on the nerve and not originated by the nerve.[1]

> "A perfectly constructed galvanic battery is *inactive* while the circuit is interrupted," but becomes *active* the instant that the circuit is closed; so does a sensation, an instinctive tendency, an emotion, an idea, or a volition which attains an intensity adequate to close the circuit, liberate the nerve force with which a certain part of the brain, while in a state of wakeful activity, is always charged. That mental antecedents can thus call forth physical consequents, is just as certain as that physical antecedents can call forth mental consequents; and thus correlation between Mind force and nerve force is shown to be complete *both ways*, each being able to excite the other (Carpenter, *Mental Physiology*, p. 14). Bain says, "If it so please us, we are at liberty to say mind is the source of power, but it must then mean by mind, the consciousness in conjunction with the whole body, and we must be prepared to admit that the physical energy is the indisputable condition and the conscious is the casual" (*Mind and Body*).

With whom is the logic, with Carpenter or with Bain? We live in the facts of life only as they are exhibited in the fact, consciousness. Science itself is only a system of probabilities; or, as Huxley says, "trained and organized common sense." Tait tells us, "nothing of value can be lost, but becomes a stepping-stone on the way to future truth;" demonstrated effects as we know them in consciousness. Carpenter says, some philosophers

> "Who have attended exclusively to the close relationship which indubitably exists between corporal and mental states have thought that *all* the operations of the mind are but manifestations, or expressions of material changes in the brain; and thus man is but a *thinking* machine, his conduct being entirely determined by his original constitution, modified by subsequent conditions over which he has no control, and his fancied power of self-direction is altogether a delusion; and hence the notion of *duty* or *responsibility* has no real foundation."

We have ideas through sensation, and ideas independently of sensation. When ideas are refined into thoughts by reflecting on them, they become reason, *i. e.* a power to balance conflicting ideas, to arrange them in order, to array fact with fact, ideas with facts, as we understand them, and ideas which flow from facts with ideas which arise in the interior processes of thought, it may be from memory (re-collection),[2] and it may be from an influx or flowing in of ideas which seem to have no antecedent; the solution of a train of ideas and comments on facts long pondered on without a satisfactory result being obtained, but when attained, satisfactory and perfect, *e. g.* when Archimedes solved his problem and established the law of fluids. There are also thoughts which arise presenting facts as reasoned conclusions, which no preceding train of thought appears to have instigated,[1] and sometimes are opposed to the conclusions of experience, but which on an analysis appear to be based on truth—this is intuition. Thought consolidated by reflection and impressed on the consciousness is wisdom. If there be an interior mode of thought acting without a conscious impulsion, but when impressed on the consciousness is found to be completely in consonance with some conception previously entertained but not matured by reasonings, and which yet without effort thrusts itself on the consciousness, giving a perfect answer to some problem before undetermined, and for which we had vainly sought the answer, then we have two minds, so to speak—an external mind, which busies itself with the facts around us, reasoning on their presentments; and an interior mind, which acts without conscious effort as an outflow from the recesses of thought. This is an informing, derived from a source over which we, seemingly, have no control, inspiration,[2] a power of the mind which all men experience, and upon which the religious reformers in all ages of the world have confidently relied. Call it frenzy or what we may, it nevertheless is an intellectual sequence from whence derived we know not, but which all must admit. It is that lightening of intelligence which Tyndall ascribed to Newton (*vide* p. 124).

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[1] The motion of a limb implies an active state or change in both classes of muscle, the one to contract, the other to relax. Were it not so, the attempt at action would exhibit the body convulsed in clonic spasms (Bell, *B. T.*, p. 112).

[2] Erasmus Darwin divides ideas into "ideas of recollection, as when we repeat the alphabet backwards;" and "ideas of suggestion, as whilst we repeat the alphabet in the usual order" (*Zoonomia*, v. i, p. 22).

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[1] We laugh at clairvoyance; yet there is a clairvoyance unknown to ourselves, that of "the wakeful intellect," which "has originated all the manifold knowledge we now possess, predicted each step of our progress, divined every obstacle that encumbered the way." "Every art, every craft which gives bread to the millions came originally forth from some brain that saw it first in its typical image." "It is obviously undeniable that every invention added to our uses must have been invented before it was seen—that the image must have appeared to the inventor 'through some other organ than his eyes.'" Ingenious critics on Shakespeare—so true are his descriptions—imagine he must have seen the Samphire gatherer; that he must have travelled in Italy; that he must have been versed in legal technicalities; that he was versed in medicine; and as for philosophy, he must have equalled Bacon, &c, But then he describes scenes he could not have seen, unless, like Pythagoras, he had acquired his knowledge in former lives. Was he with Marc Antony when, at Cæsar's funeral, he made such use of Cæsar's will that he obtained from a Roman jury a verdict against the liberties of Rome? Was he with Brutus, in the tent at Phillippi when the shade of Cæsar passed before him? or with Prospero on his island, where he allegorizes the distinction between brute force and intellect? How long might be the list if we collated biographies! What names would appear of men who believed in the ideal influences foreign to their own minds! All genius is the clairvoyance of intellect—inspiration if you will. Is it only those whom "stockbrokers" would call children of fancy, "and the learned physician" classify among "highly nervous patients," who are so intended? Bulwer says he has minutely described scenes he had never seen, which, on a subsequent examination, he had found in every feature correct; and continues, "in no single instance could I ever find, after the most rigid scrutiny, that the clairvoyance of imagination had deceived me." It is recorded, Kant described Westminster Bridge so particularly that an Englishman who heard him asked, "how long he had lived in London?" Kant had never been out of Prussia. In conclusion Bulwer says, "When a marvel is related to me, the narrator is disappointed when I say, 'is that all?' I find instances of normal clairvoyance more wonderful than those erratic gleams of lucidity in magnetic sleep, which one man reveres as divine and another man disdains as incredible" (vide *Caxtoniana*, Essay 4).

[2] "To imagine things they have never seen, and to imagine them accurately

In all natural phenomena there are actions by affinities—mind would follow the same law, supposing there is a universal mind, for all facts of law are universal in their application. There are affinities between mind and mind, mind impresses mind, but not in the sense of an inspiration. All facts of phenomena point to an intelligence active in the world of sense, then in the receptivity "of likes with likes"—the human mind, *quâ* mind, is positive as to direction, but negative as to impressions. It is impressed by the symbol reflected in the eye, impressed by the outflow of other minds, impressed by the intelligence underlying phenomena; and if we personify that intelligence, which we do, however unable to prove such a persónification, *the human mind has affinity with the great positive or universal mind* by impression, and this impression—this inflow of thought—this instantaneous conviction, is that called intuition or inspiration. This receptive affinity can arise only through ultimate conditions, whether we call them soul or spirit, and in any case it is a reflex of that intelligence we know as *the cause* (*vide* note 1, p. 157). If we take the mechanical impression of phenomena we have consciousness and heat, *i.e.* mind and organism; without heat life could not be, nor mind without consciousness, nor consciousness without vitality: *thus we arrive at a living intelligence expressed in the cognition I am, whether it be thinking I think, or I think.*

The *Ego* is an unparticled present, unchangeable, it is the forever existing self—the individualism. The shifting *Ego* and states of consciousness are cobwebs of science. *Of states of consciousness and shifting Egos* the true plan is, cut the knot and say, *I think, that is my Ego*, I am conscious of my identity of thought, I am conscious *I hear a sound when another Ego speaks.* Deny the *alter Ego*, call it a *non Ego*, what is the gain? Repetition of thought, act, and speech shows the *non Ego* to be as individualized in its facts as the *Ego*, the personal self of which I am conscious. Consciousness may be passive so far as present conception is concerned, as when we sleep, we dream (*vide* note 1, p. 149). On awaking we are conscious we have been thinking, because we can recall the thought, or picture impressed on the consciousness, the involuntary fact of our conscious being. We may define and

constitutes the poetry of philosophers as it constitutes the philosophy of poets" (*Bulwer*).

cavil, but we come to the fact that thought is a conceptive existence, non-existent perception is unthinkable.

It is idle to talk "of automatic and reflex consciousness, we should be puzzled to make the present out of the past, *i.e.* out of forgetfulness." When we speak of a force as will, *as that I can do*, *or that I will do*, we speak of a will power to consummate an act. It is quite inconsequential that the act fails to be completed from a want of power. We may will to do and yet not do, we may will to do and do—the increment of the will is an existing principle of the mind and motor of our acts. We (generally) know the certain by its opposite or by contrasts of conditions as pleasure and pain, not as states of consciousness. To remember is an act of will, we may fail to recall a thought, but the failure to re-collect is not a failure of the will, but of the memory. It is the fashion to say all things are the results of matter, or of force. Mind is no fact of matter, although it uses matter as its fact of conduction, nor of force, as it uses force as the expression of its own fact. All results flow from a cause, or impulse; force resulting from a conscious intent becomes a conditioned effect. "Whenever and as often as I choose that the condition necessary and sufficient for the beginning, continuing, and ending of an effort is my free choice and will," I do, or do not do, the power to act or not to act shows a power of control. A thing controlled is dependent, and cannot be a creator. The will may exist to control all force, but the power may be inadequate to consummate the intent: this is no failure of the will. The organism is controlled by the will and at the same time is acted on by its environments. The measure of the power of the will is exactly that of the power possessed to consummate an act of the will. Force, although it may be used as a cause, and controlled as an effect, in all cases wants an external or motor energy; an imperative law induces a certainty of sequences, and this certainty is the condition of life.

Kirkman (*Science without Assumptions*) says, "Can I find with demonstration that there is in Kosmos any conscious being besides myself?" In proof, says, "All groups of phenomena will seem to me continual and consistent indications of conscious intelligence and will, and are to me demonstrations of the real presence and actions of intelligence and will." If asked to prove this, I say "all consistent phenomenal indications to me of indivisible consciousness, intelligence, and will, are verily to me demonstrations of the unseen verities indicated;" and if pushed further would reply, "that it is a fundamental truth of reason, the denial of which is absurd." "When I affirm I am and I will at my starting point, I affirm all that is given in this Kosmos of forces;" "but something more is needed when the speaker is face to face with his fellow-man." A man says to another man, "thou art a conscious thinker, with a certainty due to self-evident truth;" and when he says "I am," expects the other to say "thou art." "Psychologists generally decline to demonstrate thou art a conscious thinker, under the plea that they do not pronounce it as an absolute certainty of science;" and they "fly to assumptions as a probable explanation of the phenomena," and say "we are satisfied with the verification of our hypothesis which experience supplies; but how can experience verify a supposition of that which cannot come into experience?" "How much better is the affirmation of a conscious spirit, invisible, here in converse with mine." Convictions of natural phenomena are stated with an if; "but when looking into the eyes of another man, where can be found *an if* to qualify his confession—thou art and thou continuest to be a conscious thinker?" "To express certainty of another's consciousness by sympathy is vague." "The mutual needs are sufficiently included, as the less under the greater—I am and I will."[1] The duties have their root in, "I ought." "I ought to treat him as one who thinks and feels." "The verification of this proposition is found only in consciousness." "It is impossible scientifically to demonstrate that a worm feels."

Mill, Spencer, Bain, &c., agree that "men are only conscious of a succession of feelings," yet it has been demonstrated that consciousness may be without feeling or sensation, and feeling and sensation without consciousness (*sup.* p. 117). A man is conscious of himself, *i.e.* of his *ipse;* he requires neither feelings nor sensations to understand that if feeling is to be construed as I know, then consciousness is both sensation and feeling. Huxley says: "Nor is our knowledge of anything more or less than a knowledge of states of consciousness, and our life is made up of such states, some referred to a cause we call self, others to a cause, or causes, not self." There can be no distinction between self as distinguished by reflection, and self as presented without reflection; mental states exist, but self and state require reflection for their complete recognition. The *Ego* is implicitly there, a series of means, a succession of entities, but consciousness is of the present, the fact of the moment; if of the immediate past it is persistently present. "How can a series be conscious of itself as a series?" "No fact is more present with us than our own personal consciousness of an identity personally present, and no conviction is more constantly acted on by us."[2]

The impossibility of finding the law which comprises all mental facts in a classification is due to the distinctions in organic arrangements,—classes of effects, mental possibilities being also classes of effects,—but with which science determines to have nothing in common, except as existing together as servitor and lord. In investigating material things we accept their presentments, regardless of the assumed fallacy of the senses, but in investigating mental phenomena we fall back on first principles, I think, I am, I feel, are the postulates, and are told we think we are, and we think we feel; *without thinking I think there is no consciousness, so the thinking fact proves its own postulates.*

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[1] Kirkman defines will—*first,* "that I freely choose the time, the manner, and measure of the force for the performance of the act;" *second,* "that I freely put forth that will-force which sets in motion those instruments which are placed under the command of my will" (*Science without Assumptions*).

[2] "It is obvious the thinking being, I call myself at this moment, is substantially one and the same, identical with the agent who carried on the long series of acts and endurances I call myself;" and "contains the intuitions of a long and substantial unity, which reason tells us, if we can be certain of anything, is due to a peculiar faculty we term intellect." "If we may make any assertion at all, it is an affirmation of our existence, and yet that cannot be made without accepting the trustworthiness of memory" (*Lessons from Nat.*).

That which the theory of the correlation of forces is to science, the correlation of the facts which constitute science is to philosophy. Our knowledge "is like a great river flowing between its banks, but whose source and mouth is unknown." To condemn a research into ultimates is to lessen the power of the mind, for its true mobility consists "less in the results it obtains than in the end it proposes to itself." When we have done all we can, who can prove that material consequents are of more value than ideas? If all the questions concerning the unfathomed ideal and ourselves, all our researches into being and origin could be answered once for all, there would be reft away many an entrancing dream of faith; but in lieu we should have a certainty instead of an ideal, a fact for a hope. Culture would then be expended in making the actual as perfect as the ideal, and the subtleties of inferences would become certainties of truth.

Science demonstrates that the world existed before organic life was manifested on its surface; if a continuity be necessary to make its existence a perception, then an idea existing in the unseen was the consciousness which sustained it. This position has been contested, but has never been disproved. If then, phenomena only exist in our perception, if we have no perception of them, it is the same (to us) as if they did not exist; it then follows existences are only real as conceptions in consciousness. The phenomenal and the ideal are equal in their stringency as to fact; the phenomenal as to life, the ideal as to existence. Thus we have the phenomenal as the organic with all that pertains to sensation; and the ideal, or all which pertains to the abstractions of the mind or intelligence—an existence in Spirit. The ideal has no place in the phenomenal; then, as it exists only as an abstraction, it creates a world in its own conception, and is an existence in the unseen. In our life the sensuous and the ideal intermix, *the sensuous feels, the ideal thinks.* The sensuous is the life, the ideal the spirit, vitalized through the impact. Mind thus becomes a principle of continuity existing in consciousness and as a fact of the unseen. This continuity so much insisted on would be unbroken even if there were no mental abstraction; thus in the unseen we find the real.

The comparisons drawn by Locke of the mind, as an unwritten sheet of paper and as a cabinet, are false, because the paper has no inner potence or capability to become a record, or the cabinet to be filled except by acts wholly apart from them. Whatever be the capacity of the mind, it arises from an innate potence to receive, to record, and to accumulate impressions through its own innate power, to discriminate through and to develop through experiences; this development, however acquired, is culture. A stress in Locke's argument is laid on innate ideas, but on consideration it will be found to be wholly directed to reasoned abstractions, not to the potence, but to the perfected intelligence.

CHAP. VI.

EVOLUTION AND AUTOMATISM.

KNOWLEDGE is the sum of our experiences and ideas, the outgrowth of symbols expressed in words. The child commences by giving utterance to sounds, imitations of other sounds, the significance of which it learns without troubling itself with metaphysical or philosophical considerations—this is the acceptance of an authority to be differentiated by experiences and verified by evidences. To accept assumed facts without inquiry because of a name is too frequently a restriction to dogma.[1] Authorities conflict, and when theories are supported by *a name*, the name of the enunciator counts for something. It is from the collision of opinion and the examination of the causes of these collisions, and of the evidences upon which the theories are based, that knowledge arises.

The Evolution theory is the presentment of a plausible possible, an attempt to explain the method of creation[2] by the examination of sequences and changes and the operations of law.[1] "The study of development proves that the doctrine of unity of plan is not merely a fancy, that it is not one way of looking at the matter, but it is the deep-seated expression of natural facts." (L.S.)[1] The attempt of science is to disclose the methods of nature, subject and object; dogma only asserts. "The Lord God formed man of the dust of the ground," &c. (Gen. ii. 7). Gen. i. 11: "Let the earth bring forth grass," &c.; ver. 12, "And the earth brought forth grass," &c.; ver. 24, "Let the earth bring forth the living creature," &c. These dicta go far beyond any theory of evolution, for it is an express declaration that from the inorganic the organic was evolved.[2] It is spontaneity in its barest aspect. The theory of evolution has been assailed (the exceptions are rare) by the Church and her adherents, as being subversive of all true religious tenets, yet evolution never spoke so loudly as Genesis does. If Genesis is held to be a fundamental dogma, a severer blow has been dealt by the discovery of the Assyrian tiles than all science could urge, or the theory of evolution subvert. We have in them an unbiassed witness that the legends on which as a revelation the creative theory expressed in Genesis is based, existed in Babylonish mythology centuries before the advent of Moses, and even before the Jews were a people.

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[1] In all ages the attempt has been made to repress freedom of thought. So late as 1746 such was the dread of the power of the Church that Boscovitch, desiring to argue a question of physics, remembering the persecution undergone by Galileo, commenced by saying, "As for me, full of respect for the Holy Scriptures and the decree of the Holy Inquisition, I regard the earth as immovable; nevertheless, for simplicity in explanation, I will argue as if the earth moves, for it is proved, of the two hypotheses the appearances favour that idea" (*Warfare of Science*).

[2] Helmholtz says, "Assistance, that cannot be too highly valued, towards the elucidation of the fundamental principles of the doctrine of life, has been rendered on the part of descriptive natural history, through Darwin's theory of the evolution of organic forms, by which the possibility of an entirely new interpretation of organic adaptability is furnished." "Formerly natural affinity appeared to be a

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mere enigmatical and altogether groundless similarity of forms." "The facts of Palæontological and Embryological evolutions and of Geographical distribution were enigmatical wonders, so long as each species was regarded as the result of an independent act of creation, and cast a scarcely favorable light on the strange tentative method which was ascribed to the Creator. Darwin has raised all these isolated questions from the condition of a heap of enigmatical wonders to a great consistent system of development, and established definite ideas in the place of . . . fanciful hypotheses."

[1] Dr. Child says, to a believer in evolution, "It seems an almost irresistible conclusion that there must have been a stage in the development of the universe when the earliest forms of organic life were evolved by special collocations of inorganic elements, by the continual operation of laws already in action."

[2] In order to overset the *teleology* of Genesis, it is asserted that the idea "of the grand doctrine of design in nature" is overthrown. Genesis no doubt was the epitome of the science of its era, when spontaneity, as *generatio æquivoca*, occupied the place of development through an almost endless succession of animated forms. The succession of events, as recorded in Genesis, have great analogies with the Geological eras. The idea of Genesis as being an express revelation is disrupted by the discovery of the Assyrian tiles. If their record is to be received, the conceptions contained in Genesis were in existence some hundreds of years before the birth of Abraham. The Noachian flood is almost exactly narrated in the legend of Izdubar. Darwinism must stand on its merits or fail through its demerits. Genesis tells nothing for or against it; and nowhere, as asserted by Dr. Potter (*Scien. Revel.*), do I find Darwin assumes the possibility "*of a medley of blind chance.*" Potter, in this instance, appears to draw as largely on his imagination as Darwin does on Pangenesis. It is by such shifty and baseless assertions that the Church, in the zealous ignorance of her defenders, receives hurt. Revelation, whichever it be, ideal or fact, in the universal only can find a fundamental basis.

"Darwin's theory of descent does not abolish or deface the distinctions between the different genera and species of the naturalist, it only explains them genealogically. It does not represent the variety of living forms as having been developed in one long line, but after the likeness of an extremely ramified tree. Hence it allows us to speak of absolutely distinct species. There are absolute distinctions between the mouse and the eagle, and there may be such distinctions between man and the anthropoid ape. Man may never have been an ape, and the ape may never be able through development to become a man. They may have had a common ancestor, and may always have been and may be to all eternity in themselves distinct" (Steinthall).[1] The facts which science has collected as evidences of the theory of Evolution are so pertinent that "the denial of Evolution is not worth serious consideration" (*Huxley's Biology*). The conclusions arrived at are—"that a fundamental uniformity of structure pervades the animal and the vegetable worlds, and that plants and animals differ from one another simply as modifications of the same great general plan" (*ib.*). Lyell says, the theory of Evolution[1] seems so simple when once clearly stated, and so consonant with known facts, that many have a difficulty in conceiving how it can constitute a great step in the progress of science;" and he further aptly observes, "Such is often the case with important discoveries, but to assure ourselves that the doctrine is by no means obvious, we have only to refer back to the writings of skilful naturalists," and "when once enunciated it (the Evolution theory) is so obvious as scarcely to need proof" (Spencer).

Natural selection, as presented by its originators, Darwin and Wallace, professes to suggest the method of creation, not the fact of creation or spontaneity.[2] Its authors both assume an

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[1] The *Times* critic, commenting on German materialistic works, says, "We should pass over one of the salient remarks of this literature if we said nothing as to the important part played by the Development Theory." After speaking of "the extent to which speculations about atoms figure in it is remarkable," he continues, "But the multitudinous ways in which Mr. Darwin's theory is applied are still more surprising. . . A little too much is made in popular scientific works of the ancestral ape, who is treated with all the respect due to the founder of the family. Just to spite the theologians, dozens of controversialists give daily thanks that their first parents did not live in innocence in Paradise, but swung themselves by their tails in primæval forests. No doubt the German materialists lay stress on the connection between man and the lower animals in order to uproot common ideas as to teleology; to emphasize the view that man is not qualitatively different from the higher mammals; that his brain, if more potent than theirs, differs only in degree; and that the boasted isolation of man from his ministering dependents is but the dream of soaring pride and egotism!"

[2] Oken and La Mark derived life from the sea slime, mucus, or mud; this Haeckel hails as a great stroke of genius. The Phœnicians and Egyptians said something similar and more circumstantially thousands of years before. Sanchuniathon first speaks of a chaos which embraced the wind and "brought forth *mot*, which some call *ilus* (mud) others considered it but as the putrefaction of a watery mixture, and from this sprung all the seeds of the creation and the generation of the Universe."

"If a planet were carved from the sun and set spinning round an axis, and revolved round the sun at a distance from him equal to that of our earth," "one of the consequences of the refrigeration would be the development of organic forms!" (*Vital. Frag. Sci.*).

Huxley says, "Were it given me to look beyond the abyss of the geological recorded time to the still more remote period when the earth was passing through physical and chemical conditions, which it can no more again see than man can antecedent originator; the latter does not hesitate to name it spirit. It is a higher estimate of divine intelligence to suppose that it was so far seeing that on the calling into being the unit of life it was competent to produce all the sequential consequences we call natural phenomena, than to suppose such an intelligence manipulated every variation and separately imprinted each dot and line. There can be no pause, the choice is of one method or the other. If this be not admitted, where is the distinction to be made? There can be no assumption of "heredity" of descent, for then the antecedent would contain that which followed, and that whether the result arose from an immediate antecedent, or whether there were a long ancestral train, the principle is the same. It is a grander thought to suppose a germ contained all the variations to follow, disclosing thereby an intelligence with an *ability* to think, linked with a power equal to *the consummation* of the thought. "One truth can never contradict another truth," nor are "the statements or opinions of men, however scientific, necessarily scientific truths."[1] Does it appear that the theory of evolution is contrary to truth? It would be difficult to suppose when evidences of existing facts are produced that the facts themselves are purposeless. It is more probable that the objectors are wanting in the knowledge of biological facts, or that they have not the critical acumen needed to balance evidences. The logic of a fact is its own proof.

Darwin's theory by no means implies, as Birks suggests[2]

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recal his infancy, I should expect to be a witness of living protoplasm from non-living matter (*Cri. and Add.*).

[1] The *Saturday Review* (Aug. 26, 1876), in reviewing Mivart's *Lessons from Nature*, has broadly and graphically outlined Darwin's claims to consideration. He says, "A scientific mind may, with no less caution and reverence, seek to penetrate the gloom and reduce to order and law what had been held to be the inscrutable realms of miracle. Mr. Darwin is not, we think, to be fairly charged with lack either of modesty or reverence, in pushing his inquiries into the ultimate and primary recesses of life. In breaking down, as the result of his researches, the barriers between the human and the inferior races, he has not robbed man of aught of his glory as a member of a divine order of creation; while he has extended to a wider realm of phenomena that unity which it is the task of science to verify and to establish throughout nature." "For the origin of man, as for the dawn of articulate speech, there is nothing for it with Mr. Mivart but to refer us to a state of things where law is swallowed up in miracle." "How man came by these powers it has been Mr. Darwin's aim to trace. He may not have attained to demonstrative, or even approximate proof; nor does he pretend to have exhausted the inquiry, or to have clinched every link in the chain of proof." "As a naturalist and a conscientious collector of the facts of biology, Mr. Darwin is not in fairness to be held responsible for the extremes to which his conclusions may have been pushed by eager speculators in the direction of agnosticism, or even of nihilism."

[2] The idea was doubtless gained from Egyptian mummies, which show the preserved animals were of the same proportions as now, 3000 years advanced, and that they therefore were perpetuated from a creation within geological limits of 6000 years;

(*Mod. Phil.*, *Materialism*), the principle of the introduction of life on the earth, but only the mode of its successions. He (Birks) is not ingenuous when he attempts to explain Darwin by Spencer. He says, if species co-exist, there would be no gaps in the line of descent, nor probably were there—slowly the links were forged, the final process in one succession being the commencing step of the next. Considering geological periods, it seems inconceivably absurd to take as a specific period, in such a corollary, 4,000 or 6,000 years. The evolution theory[1] as a generalization takes high rank, although it may be said to be yet in its infancy. To assume that it is an unfounded hypothesis, because the whole of the links connecting species with species are not specified, is either the wantonness of contradiction or a proof that the assertor has an utter inappreciation of scientific evidences. Sciences are progressive, and when presented as systems the steps have been prepared by other thinkers. One of the fathers of the chemical science (Lavoisier) was anticipated by Scheele, who really worked out the basis on which Lavoisier founded his scheme. Darwin had his predecessors, a synopsis of whom he gives in his work. (*Origin of Species*).

Darwin appears to have left his defence to his friends, and well they have redeemed his confidence. His inductions and examples have proved that "creation" means development; his proofs are facts, not *à priori* assumptions but processes of analysis by which he shows the purposeness of creation, his method according with observation and reason.

The Palingenesis of the Druids, as reported by Henry Martyn, and the expressions of old Welsh bards, are remarkable as presenting a theory of evolution dating backwards at least two

or from Aristotle's descriptions, which, in many respects, are applicable to those of the present day.

[1] Dr. Elam (*Winds of Doctrine*) is one of the commentators on the theory of Evolution, and strangely connects Automatism with it. His value as an expositor or critic is shown by his reproving Büchner, who in effect declares the same hypothesis which in the *Belfast Address* is attributed to Giordano Bruno and Gassendi. If Büchner is to be reprobated for his theory, should Tyndall be exalted for analogous statement? Elam speaks of "the eloquent address delivered by Professor Tyndall at Belfast," and with unimaginable simplicity asks, "When Professor Tyndall discerns in matter the promise and potency of all terrestrial life does he really mean this?" Tyndall answers for himself when he pronounced his conclusions as to the spontaneity of life—"I shall hardly be charged with any desire to limit the power and potency of matter in regard to life. On this point I have already expressed myself in a manner not to be mistaken. Holding the notions I do it is all the more incumbent on me to affirm that, so far as inquiry has hitherto penetrated, life has never been proved to appear independently of antecedent life" ("Putrefac. and Infec.," *Frag. Sc.*, 5th ed., p. 17). Elam, in the face of this re-utterance, quotes from *Scientific Materialism* (*Frag. Sci.*) something as to the facts of consciousness apparently to his own satisfaction, for he says, "this reduces the omnipotence of matter to the very innocent cry of wolf."

thousand years. He says the Druidical theory is complete. It takes *being* at its origin, and conducts it to the ultimate heaven: in the interval before man, there is no consciousness of the gifts latent within it. Being "is created in the lowest stage of life, *Annwfn*, the shadowy abyss at the base of *Abred;* there surrounded by nature, submitted to necessity, it arrives through the successive degrees of inorganic matter, and then through the organic; conscience (consciousness) at last awakes and being becomes man. Three things are primarily contemporaneous, Man, Liberty, Light. Before man there was nothing in creation but fatal obedience to physical laws; with man commences the great battle between liberty and necessity, between good and evil. The good and evil present themselves to man in equilibrium, and he can at his pleasure attach himself to one or the other of them" (*Flammarian Hist. of the Hea.*, Blake).

"The Druids considered living beings were divided into three circles. *Cnegent*, the circle of immensity, belonged to God alone. The second circle, *Gwyn-fyd*, the circle of blessedness, was heaven, the abode of beings who had arrived at superior degrees of existence. *Abred*, the third circle, was that of voyages comprising all novitiates, there at the bottom of the abysses of the oceans," as Talliesin says, "the first breath of man commenced" (*Ib.* p. 30).

In the theory of evolution where is the imputed impiety? where the idea derogatory to the Infinite Supreme? It is an unfolding and refolding, *Energy made holy as work.* Creation, or whatever else be the phrase, shows a purposeness, the adaptation of a means to an end—every added little, every minute variation, declares the commenced magnitude.

Was Descartes, by the stress of his argument, compelled to make the animal world automatic? others more or less support such an hypothesis. If it be true of one sentient living thing, it is true of man; the whole question resolves itself into the meaning intended to be conveyed. If is meant an energy having no antecedent, then the slightest action of will scatters it to the wind; if is meant actions resulting from unconscious energy, it is equally a fallacy. We will to walk, and continue to walk without conscious effort, in the same way that a clock continues to go whilst there is a pressure on the wheel. Internal organic functions are performed without conscious effort, but does it follow that these functions are not the consequents of an antecedent of which we are not conscious, for when there is functional derangement by our sensation we become conscious of it? When an operation is performed, the patient being under the influence of chloroform or gas, the moans and shrieks of the subject show that sensation is active, yet on the influence passing off the sense of pain has not been impressed on the consciousness. Sounds appear to accompany sensations: a dog yelps when trodden on, a child in its earliest infancy, before it is conscious of surrounding influences, cries on a derangement of its functions; because it is unconscious of an acting influence, is it to be said the act of crying is automatic? Do not the cries rather appear to be the accompaniments of sensation? It is the same with the man on the infliction of pain. Cries when suppressed are suppressed by the act of the will. To insist that because the ordinary functions of the organism are unconsciously performed, that therefore they are automatic, would be to say that sensation is the result of a deranged function. Where is the proof of the automacy? The law of nature appears to be that in the ovum or germ the functional power arises and continues until the fœtus is developed; and then, as before, the functional offices are unconsciously continued. Were it otherwise, functional facts would be inorganic results, and only organic when consciousness is awakened. The normal state of organic function is a continuing unconscious action, and this is shown, in that immediately a derangement occurs sensation becomes present; because of this, can we suppose that conscious function is the abnormal state of an organism? If functional derangements produce sensation, is sensation created by the derangement? If, on the other hand, it be said that the sensation was existing, but only made apparent on derangement, the whole theory of automatism would thereby be subverted. The living principle in vegetation, in the extremest view, is a life without conscious sensation. Plants can be paralysed under the influence of drugs, and when conditions are ungenial they fade away. Surely there can be no automatism where there is an exciting antecedent, although consciousness does not supervene. Where there is a vital antecedence it is difficult to say that an action is automatic? We have life without consciousness, with conscious sensation, with a directing conscious will—instinct and intelligence. Life, consciousness, sensation, and mind in some form are the antecedents of animate phenomena.

Descartes said, "I think—therefore I am." With equal truth he might have said, I feel, and therefore I am: I think, discloses the mental or conceptive; I feel, the organic, or instinctive perceptive; to be man one must both think and feel. The thinking (by evolution) would disclose a spiritual principle, *i.e.* the supersensual, which, if there be an existence in the unseen, may be presented in form, although it may not be an *organic* form, and may possess function, although not organic function. If there be a persistent life we cannot assume automatism to be its fact, because being formulated in law it implies a law institutor. Huxley and Tyndall deny spontaneity, and therefore must assume an antecedent. So far as man is concerned there can be life without consciousness. This to him would be *no being*. Automatism as formulated involves not only *no* being but knowing, or conscious being. Organism (no being) becomes the vehicle for the display of being, or will, as an effect. I say persistent life formulated in law, because will is a fact of the consciousness. Walking originating in will becomes a continuing fact without the conscious exertion of will, but this does not remove it from the domain of will; the unconscious continuance of the act is a consequent of the antecedent conscious act of the will (*vide* note 1, p. 97). Functional effects follow in the order of this reasoning; hence the distinction between voluntary and involuntary action, in the sense of automatism, does not appear to be a logical induction. There is cerebral action, *i.e.* mind action and life action, and that also of the medulla oblongata. The latter may be conscious or unconscious, but an act of the will is always consciously performed. In dreams we have a cerebral action, although seemingly not instituted by, yet is a continuation of conscious will. There is sometimes an inflow of thought impressing the consciousness, for which there is no apparent antecedent.[1] Is this automatic?

Huxley defines man "as a conscious automaton" (*Fortnightly*, 1874, p. 57), but qualifies his definition by saying "he is endowed with free will." Elam (*Winds of Doctrine*) rightly remarks, accepting the definition in the generally received sense, "An automaton endowed with free will is certainly an interesting novelty in physical science." "Man, as an automaton endowed with free will," leaves the question exactly where it was, intelligent free agency. If the exegesis of the science of the coming time has its tentative power in such expositions, we need not covet "that greatest intellectual revolution mankind has yet seen," and which, it is said, "is slowly taking place by the aid of science."[2] Nature enforces obedience to her law, and always exacts the penalty of disobedience. In the face of the teaching of the automata, "what are to be the actions of the immutable *moral* and physical laws," and where is "the value of evidence?" Are we to believe that "the highest possible aim of an intelligent being" "is the negation of intelligence and will," with which are connected the moral rule? Where in such teaching is the value "of observation and experiment?" and when it is connected with *the denial of the existence of spirit*, we are involuntarily drawn in to the contemplation of the ludicrous picture of worship delineated by Kirkman (*Science without Assumptions*). It were better indeed to accept, as a fact, the wildest dream of fanaticism, there at least is the promise of an ideal future. In the face of the dogmas of *matter and automatism*, man indeed becomes the *possibility* of *nothing*, a dream and an insignificance. Carpenter divided actions into voluntary and involuntary, the involuntary being those termed automatic.[1] The physiological function appears to be the only fact on which automatism can be based, a conscious or unconscious function. Carpenter further says:

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[1] Luther goes further than our hypothecators. He says, "The human will is placed between two, even as a beast of burden. If God mounts it, it wishes and goes as God wills. . . . If Satan mounts it, it wishes and goes as Satan wills. Nor is it free to run towards and select either rider; it is the riders themselves who contend which shall obtain and hold possession" (*De Servo Arbitus*). Whatever he knew of theology, certainly he was a very doubtful physicist.

[2] The boast of the physicist is "That science is teaching the world that the ultimate court of appeal is observation and experiment, and not authority. She is teaching it to estimate the value of evidence; she is creating a firm and living faith in the existence of immutable, moral, and physical laws, perfect

> "The psychologist may fearlessly throw himself into the deepest waters of speculative inquiry in regard to the relation between his mind and his bodily instrument, provided he trusts to the inherent buoyancy of the great fact of

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obedience to which is the highest possible aim of an intellectual being" (*Lay Sermons*).

[1] In the relations of will to bodily movements, he says, "It has been customary to class these as *voluntary* and *involuntary*, but it will be found preferable to distinguish them as *volitional* and *automatic;* the former being those called forth by the distinct efforts of will and directed to the execution of a definite *purpose*, whilst the latter are performed in respondence to an internal prompting of which we may or may not be conscious, and are not dependent upon any performed intention, being executed—to use a common expression—mechanically. Some of these are *primarily*, or *originally* automatic; whilst others which were volitional in the first instance become by frequent repetition to be performed independently of the will, and thus become *secondarily* automatic. Some of the automatic movements again can be controlled by will, while others take place in opposition to the strongest volitional effort. There is a large class of secondarily automatic actions which the will can initiate, and which then go on of themselves in sequences established by previous habit, but which the will can stop, or of which it can change the direction as easily as it can set them going; and these it will be convenient to term *voluntary*, as being entirely under the control of the will, although maintained automatically" (*Mental Physiology*, sec. 14). He further says—but which appears to have but little to do with the true bearing of the subject—"The automatic activity of the body, and the volitional direction by which it is utilized and directed, may be compared to the independent locomotive power of a horse, under the guidance and control of a skilful rider." "When the power of the horse is exhausted no further action can be got out of it, but all motion has been determined by the will of the rider; but there are times when the horse obtains the mastery and gets beyond the control of the rider. This is exactly what we see in spasms, convulsions, and sneezing without the loss of consciousness. So in a fit of abstraction in a rider the horse will carry him home without direction, exactly what occurs when we are walking along a course with which habit has made us familiar and we probably are absorbed in reverie" (*ib.*, sec. 24).

consciousness, that we have within us as a self-determining power which we call will; and he may even find in the evidence of the interior relation between mental activity and physical changes in the brain the most satisfactory grounds which science can afford for his belief that the phenomena of the material universe are the expressions of an infinite mind and will, of which man is the finite representative" (*Mental Physiology*, p. 112.)

We may then say, with Justin Martyr, "faith is a conviction implanted in the human mind of something ineffable."[1]

If man be considered in his dual relations, this question of automatism becomes much narrowed. The assumption accepted; man as a conscious automaton, we have then an unconscious function acting on the organism as an inherent fact of the vital principle—where would it lead us? Wisely indeed was a lethe spread over the functions of the viscera and the action of the absorbents, &c. What would be more distracting than that every functional act should be consciously noted? When conscious function exhibited as will compels a mechanical fact, it requires a wide stretch of the imagination to conceive it to be automatic. Admitting, for argument, that the vital e-mutations and their natural chemistry are automatic or unconscious acts, and that the mechanical as conscious acts, become unconsciously performed, as in neither view could an antecedent motor be ignored, it seems to follow the automatic theory, as put by Descartes, or Huxley, or as explained by Carpenter, is a baseless hypothesis. Remotely connected with the automatic theory is that of free will. If man be an automaton, there of course can be no such a result as will, leaving out of the question all idea of the freedom of its exercise; but, supposing man be not an automaton, a wide field of speculation is opened out, and herein physicists, psychologists, and theologians revel.

We find creation or the phenomena of Nature established, and therefore must assume that its cognition in the consciousness of man had its purpose, as at the head of creation he is found—organized, conscious, and mental. If evolution or progression be more than an hypothesis, we must then say, if there were divinity in the constructing power by which nature exists, or an intelligence manifested in its designs, that there was a purpose in putting *dual* man in the prominent place he occupies in its phenomena. This conceded, we then say, when the body dies the intelligence continues to develop, and by reason of its individualism, even when disembodied, it still continues to be an existing entity, spirit, or essence, and to use the words of Davies—

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[1] Shelley, in an unfinished essay on Christianity, wrote—"We live and move and think, but we are not the creatures of our own origin and existence. We are not the arbiters of every motion of our own complicated nature; we are not masters of our own imaginations and moods of mental being. There is a power by which we are surrounded like the atmosphere in which some motionless lyre is suspended, which visits with its breath our silent chords at will. Our most imperial and stupendous qualities—those on which the majesty and power of humanity is erected—are relatively inferior portions of its mechanism, active and imperial; but they are the passive slaves of some higher and more omnipotent power. This power is God, and those who have seen God in the period of their purer and more perfect nature have been harmonized by their own will to so exquisite a consentaneity of power as to give forth divinest melody, when the breath of universal being sweeps over their frame."

> "Death is naught
> But the soul's birth—and so we should call it."
> (*On the Orig., Nat., and Immort. of the Soul.*)

If there were a purpose in the institution of the dual nature of man, whatever may be his ultimate, it follows between his genesis and this ultimate there must be an existing free will; for without this free will the mind could not be a conscious continuing entity; but nevertheless it follows that this free will must sooner or later converge into the ultimate. If this postulate be denied, it is a denial of purpose in man's creation. Why was he mentally endowed? the fact of life would have satisfied the needs of the animal organism, *i.e.* supposing life to be a *necessity* in material combinations. The organic we know by observation melts back into the inorganic, to be reinstituted for the purposes of nature. In mind we know of no such consequent, unless we are to say that mind was instituted that it might be annihilated. If so, there were organic arrangement, but no reality. Nature is harmonious, and knows no waste; its order, an endless shifting from the inorganic to the organic and a continuous reinstitution. Surely for mind there must be the same persistence of fact, if nothing else, there is the power of will—to what end? As in nature there is no waste, the ordinator of nature would be equally parsimonious in the institution of mind; there was a use in its institution, and one sufficiently important to satisfy some consummate and definite end. If the institution of mind were merely an existence and an annihilation, then the law apparent in nature would have been departed from—the institution of mind would have been a wasteful product and a wasted ingenuity. By the law of development the *ovum* or plasma spot develops into the highest form, organic man; it reaches its ultimate and falls back into itself. Law being universal, it has but one fact, development; then by this law it follows mind must reach its highest stage, pure intelligence.

The titillation of the nerve of a dead frog, or a galvanic shock exciting non-living matter, is the mere elasticity of tension, and shows that nerve substances are conductors of electricity. The accidental contact with a magnetized spatula has proved of the utmost importance to man in unfolding the methods of nature. This accident placed the magnetic secret in the possession of science; its development, through the agency of Volta and others, gave implements which showed that the entire crusts of the earth are composed of metallic oxides, revealing besides the mystery of polar attraction, and made electricity and magnetism among the useful servants of man. It should not excite wonder that the nerve apparatus of a frog proves to be an electrical conductor,[1] when in the electric ray we find the same fact, and in power sufficient to paralyse or kill a horse;[2] and, if (as reported) there be a plant growing in the wilds of South America which on contact imparts a severe electric shock, we have a vegetable repetition of the same fact.

If we start with the assumption that all consciousness is due to irritation, and that "sensations are the immediate consequence of a change in the brain excited by the sensory nerves," there would be no difficulty in proving any material hypothesis. That the brain and its nervous system are the means by which we become conscious of sensations, and by which the fiats of the will are conveyed, is a physiological certainty; but in these admissions we only conceive that the brain and the nerves constitute the apparatus by which these effects are manifested. To argue that mind—the argument goes to this extent—is the consequence of changes in the brain is to assume that the brain and the nerves are *not merely* the conductors, but the originators of mind, this is confounding cause and effect. We might just as well say that a steam engine creates its powers, when we know it merely transmits an existing force; the steam engine is just as much the creator of the force it displays as the brain is the creator of the intellect and sensation made manifest through it. The organism is a mechanical arrangement by which something foreign to it, *e.g.* mind and sensation, are made manifest, as the steam engine manifests an effect, *e.g.* force, also foreign to it. We might just as well say the hieroglyphics in a book created the intellect which placed the signs in their proper relations. Whilst the organism exists, we have an apparatus which conveys sensations and intelligences, but which, if they be substances, are foreign to its constitution. The river runs in its channel, but it does not create the water, it only conducts it. The electricity courses down its conductors; we do not say the conductors create the electricity, they only convey it. Without conduction the electricity could not be applied, and so without the brain and the nervous system there would be no manifestation of feeling or intelligence. The conduction and the power conducted are dual facts, separate and distinct. Man thinks and feels; the expression of an engine and its energizer. Functions are manifested through brain and nerve action; without the apparatus there would be no manifestation, nor would there be a river unless it were confined by its banks; nor would electricity be a useful servant of man, without the apparatus and the conductors; nor could a book convey instruction, unless the signs were rightly placed. In all the instances adduced we have implements of conduction, not the creators of effects. The brain and the nerves are living substances so long as the life remains in them, but because living they are not to be removed from the mechanical category. Grant the living organism to be a machine, what to the material hypothesis is the gain? Machines are the result of intelligent manipulation; whether they be living facts or art formations, they never would have had being unless there had been an antecedent intelligence. The thousand hypotheses which crowd the regions of science testify how learned we all can be if permitted to subvert facts, and not the least of these perversions, although at the same time one of the most mischievous, is the hypothesis of a feeling and thinking brain. Bell at all events proved the brain-mass had no feeling, and whilst with his finger he disturbed the brain pulp, the patient was conscious; but were it true "*that the states of consciousness which we call sensations are the immediate consequent of a change in the brain*," however excited, it must have been manifested by Bell's patient. No sensation was experienced, and no thought was changed, when the mass was stirred! In the light of such an experiment what becomes of the hypothesis? The automaton hypothesis *also*, despite its scientific upholders, appears to be wholly based on false inductions drawn from stated premises, and may be regarded as a peculiar idiosyncracy which sometimes men of genius indulge in. What can be more specious than the analogy attempted to be drawn in the following?—"The soul stands related to the body as a bell of a clock to the works, and consciousness answers to the sound which the bell gives out when struck." We might as truly say the cloud is the cause of the rainbow, or that the ploughshare is the cause of the fertility of the earth. However, Huxley tells us that "volition must count for something in the course of events." If for something, where are we to assign its limits?

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[1] Plutarch says, "Pouring water on a live torpedo, the hand pouring the water will be sensible of a shock. A knowledge of this fact is the subject of a trick with the boys of Rochelle, who get one, ignorant of the consequences, to pour water in a continuous stream on one of the creatures, thus subjecting the operator to an electric shock (*Thomson's Annals of Phy.*, p. 149).

[2] Matteucci showed that a species of voltaic pile could be formed by slices of muscle so arranged that the external part of one slice should touch the internal part of the next (*Correl. Phy. Sci.*, p. 131, and *Draper's Chemistry*).

All facts of organism can be reduced to a threefold unity, viz. "A unity of power or faculty, a unity of form, and a unity of substantial composition." The same formula may be used for mind—as intellect, consciousness, and will; for organism—motion, nutrition, reproduction; for the inorganic—combination, stratification, form. The error of the physicist seems to be the insisting that intellect, feeling, and will are *im*mediate consequents of matter. So far as the demonstration of the effect is concerned, they are *mediately* dependent on it, for without nutrition the vehicles by which they are displayed could not be kept in their proper condition. The word *soul*, with our scientists, as in some Slavonic dialects, seems to be synonymous with stomach.

Cooke (*New Chemistry*) says, "The force with which oxygen tends to unite with other elements may be regarded as a spring," the bending and unbending of which represents energy. The facts of "modern chemistry rest on the great truths that matter is indestructible and is measured by weight." That "energy is indestructible and is measured by work." To these may be added, "intelligence is indestructible and is measured by adaptation." 'We have the three great manifestations of nature—Matter, Energy, Intelligence." A proper philosophical weight given to each "will avoid the extremes of idealism on the one side and materialism on the other."

Huxley tells us it is of little moment whether "we express the phenomena of matter in the terms of spirit, or the phenomena of spirit in the terms of matter." This mode of expression leads to confusion. To assert "that matter may be regarded as a form of thought, and thought may be regarded as a form of matter" (*Lay Ser.*), is asserting more than an alternative. Matter can only be regarded as a *form of thought* on the assumption that matter is *merely the objective form.* Thought—matter, or a consequence of matter? we might just as well say metal and wood are forms of sound, because musical instruments are of metal and wood. Matter as matter has its distinctive phases and characteristics; so has thought, sentiment, idea, and reason, but the terminology is not convertible. The terms expressive only of mind and intelligence should be used. We ought to hear nothing of curves, angles, materiality, substance, &c. Say as we may, there are always things of perception and things of conception, the latter may conceive the former, but the former would never perceive the latter. It is the miserable finessing with words which makes all the difficulties.[1] Whatever be the reality of thought when expressed in material phrases it becomes an inexpressible riddle; there is no interpreter. Where is our Œdipus? And in such contingencies we may adopt his (Huxley's) words, and say: "That such verbal hocus pocus should be received as science will one day be regarded as evidence of the low state of science in the nineteenth century, just as much as we amuse ourselves with the phraseology about nature's abhorrence of a vacuum, wherewith Torricelli's compatriots were satisfied to explain the rise of water in a pump[1] (*Lay Ser.*, 285).

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[1] Bulwer relates—A nobleman who had passed through many of the higher offices of state, and was esteemed to be *a superior man*, was the most silent man he ever met. On saying to Lord Durham, "I passed six hours with Lord —, and I do not think there is much in him." "Good heavens!" cried Lord

Developed littles are all we know in art. In nature particles piled on particles grow into mountains. By the exigency of facts we are compelled to apply the same mode of reasoning to animated forms, although man is involved in the method.[2] Intelligence does not escape. We have ideas piled on ideas. Intelligence is but an idea, qualified and distended, a magnitude arising from interior action, accumulating like the germ nucleus of the organism, by extension and differentiation, how derived through the countless ages past we know not. We perceive matter, we think thought, hence perception and conception—organism and intelligence, form and intellect—dual man. The origin of man, the inquiry as to his why and his whence, is always interesting to every man; from whence has our race come, is a burning secret which all endeavour to discover. We find the clue to the organized form, but the intelligence and the extent of our power over nature, elude us.

Light and sound may be obliterated by an intermingling of vibrations; by a parity of reasoning we should say organic func-

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Durham, "how did you find that out? Is it possible he could have talked?" The history of that man illustrates the motto—"Facunda silentia linguæ" (eloquent silence of the tongue); or as the vulgate has it, "The less said the better."

[1] "So universal is the tendency of matter to diffuse itself into space, that it gave rise to the saying, "that nature abhors a vacuum, an aphorism which . . . contains in a terse, though somewhat metaphorical form of expression, a comprehensive truth" (Grove, *Cor. Phy. Forces*, p. 181).

[2] "Were not man's origin implicated we should accept without a murmur a derivation of animal and vegetable life from what we term natural causes. The conclusions of pure intellect point to this way and no other" ('Scientific Imag.,' *Frag. Sc.*). (It quite depends what is meant by natural causes; if it be meant material causes, *pure intellect points quite another way.*) "There is little question but that organic man has the same derivation as other parts of the animal creation, and whatever exists in the earth was doubtless contained in the cosmic matter" (*vide* Huxley, *Genealogy of Man*).

"Organisms are highly differentiated portions of matter from the earth's crust and its gaseous envelope, and that organization consists principally in the formation of an aggregate by the continual incorporation of matter previously spread over a wider space;" and also that this formation depends upon "an integration of matter and a concomitant dissipation of motion, during which matter passes from an indefinite incoherent homogeneity to a definite constant heterogeneity, and the retained motion undergoes a parallel transformation" (*First Principles*).

tion and creative function through synchronous action may become immersed in each other, and thus the distinction be obliterated, we get only changes, and, because of the many converging vibrations, we are unconscious of them. When one particular vibration becomes unduly prominent we are conscious of it, because singly it impresses the consciousness. When a man has an excited nerve culminating in toothache there are no questions of automacy, there is conscious sensation in the place of unconscious action. The possible prominence of a particular sensation shows there is really no unconscious process, no "unconscious cerebration." Similarly the intensity of a thought arriving at an abstraction may obliterate the consciousness of an act consciously commenced. Thus the absence of conscious sensation is quite in consonance with sensation being active and at the same time being unremarked. We may talk of conscious, subconscious, and unconscious states, voluntary and involuntary acts, yet never be rid of vitality as the directing agent in animate forms. If there be this vital fact in organisms they cannot be pronounced to be automatic (automatic action being construed as merely physico-mechanical) by any common sense experience. "An organism is radically distinguished from every inorganic mechanism in that it *acquires through the very exercise of its primary constitution a new constitution with a new process*" (*Phys. Bas. Mind, p.* 325), *through a self-acting and interior adaptation.* Whether consciousness has a psychological or physiological form, whether as a cerebral function or a spiritual presentment, it but means, when all we can say is said, a passive medium for the reception of impressions. All the subtleties of the metaphysician or the materialist can make it none other. How it becomes impressed, or where in the organism it is situated, makes no difference to the main argument, it becomes a vital function through its impact with the organism ; the life is necessary to its cognizance, but the life can be present without its active manifestation. The most probable solution appears to be that it is existent throughout the nerve apparatus, or how shall we account for the apt instincts of the bee, the ant, and spider, creatures which have but ganglia as nervous centres? A sensation commencing in a remote part of the body travels to the nervous centre by the nerves, and is there instinctively or intelligently cognized. There is no evidence for the assumption that there is a translation from efferent to afferent conduction, or from afferent to efferent. The afferent nerve conveys the impression to the nerve centre, the excitation of will then impulses the motor nerve (efferent) into activity. There are two classes of impressions, sensory and mental ; whether the sensory be a physical fact, or whether sensation is the initiatory phase of mind, is beside the question, but it may be said, if it be physical, the impulsion occurs through the vital action of mind; it then becomes an act of the will, whether consciously or unconsciously performed.

According to the materialistic theory thought and consciousness have no more influence in determining human actions than the steam whistle has in directing a locomotive. There are two theories advanced: according to one "consciousness directs the organism, but is not of itself an organic process—it sits apart like a musical performer playing on an instrument; according to the other it is not a directing agent, but an accessory product of certain organic processes which go on as well without any accompaniment or interference of consciousness." When it is assumed that consciousness is a material emanation or product, the *reductio ad absurdam* is arrived at, it being obvious if consciousness be a subjective fact it cannot be (*per se*) material or objective. By the mechanical assumption there would be an obliteration of the subjective; nothing then would remain but a material mechanism. The subjective and objective are so intimately knit in the human organism that the obliteration of either would be the subversion of both. A stone moves by being struck, a man shrinks, a dog howls. The stone and animal are differently constituted, therefore there is a corresponding difference in their reactions, but the inference is the animal feels because I (being an animal) feel.

Adequately to explain mental processes by material conditions we must find the correlation between the subjective and the objective; we may talk of refractions, undulations, nerve excitements, and other media, and present them as the objective aspect of facts, but all are modes of perception which receive their analysis in conception, and thereby become a synthesis in thought, subjective as to impressions, objective as to facts. The animal probably is satisfied with facts, but intellect is for ever seeking factors, and finding them seeks for the factor of the factors; thus, as described by Lichtenberg, man is "the animal untiring in the search for causes." We have the self and the not self; the cognition of the self arises from the symbol of the not self, and but for the not self there would be but an existing intelligence without objective presentment, uninformed, unpurposed, an idealization commencing and ending in its own entity. The self is the individualized intelligence connected with an organism, visible and tangible through the consciousness of sensation, as I touch, and feel, I also think, and the thought is as consciously impressed as are sensations; hence arises the dualism which postulates objective forms, and a subjective world arising through the impress of a subjective intelligence.—Two existing principles, one contemplated, the other contemplating; for as I postulate myself other Egos postulate themselves, each to the other, symbolizing consciousness through separate facts. The question is beset with psychological difficulties, but what are they?—the torturing of word-sense to find an expression in scientific phrases. We have effects which all men cognize, all *know* they feel and think, the casual facts also show other men feel and think, and thus the self arises at the conception of the not self, this not self is all that is without and beyond the particular intelligence.

Certain functions are called automatic because they arise in a definitely constructed mechanism always working in the same way, whether stimulated or left to itself (as breathing, movement of the heart, contraction of the iris[1]), carry this principle into acts of the will, the will acting through a definite mechanism we have the same result. If unconscious functional acts are automatic, then all impulses are so. The power to change a motion or direct an effort are effects of vital power, as also are the visceral functions, which, although vital, may become functionally mechanical through a continuing vital energy, but it does not follow they are automatic; all unbiassed evidences point the other way.

Voluntary and involuntary actions are but differences of degree, will being the impulse in one phase, vital energy in the other. A voluntary act (conscious) continued involuntarily (unconsciously) is a continuous act of the same mechanism, and performed in the same manner, *i.e.* by an excitation of the neural state. Consciousness, sensations, ideas, and judgment play great parts in psychical explanations. It is said that in every perception there are unconscious processes only because we are unable to note every process of impression. The certainty of impression is a fact of culture: we see a mountain and without the analysis of its particles, we know it is composed of them; this part of the process apparently is unconsciously performed, but not the less is it consciously perceived; the precipient is informed of all its relations only so far as it has knowledge of the constituent facts.

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[1] Some of the examples adduced in the books are the dilations of the iris, which are pronounced to be purely automatic. Dr. Paxton, of Kilmarlock (authenticated by Dr. Allen Thomson), had the power to dilate and contract the iris at will, as had also the celebrated Fontane, and Professor Beer, of Bonn. A more important control of so-called involuntary muscular action is related by Dr. Cheyne of Col. Townshend, who had the power apparently to die and recall himself to life at will, *i.e.* repress the respiratory function and muscular action of the heart. In one of these states Dr. Cheyne, Dr. Baynard, and Mr. Skrine, surgeon, were present. Cheyne felt no motion in his pulse, Baynard no motion of the heart, and Skrine, who held a burnished mirror to his mouth, could not detect the slightest tarnish (the tests were simultaneous). The state continued so long (half-an-hour), the doctors supposed the experiment had been carried too far and the Colonel was really dead. When they were about to leave, a motion was perceptible, the pulse and motion of the heart gradually returned, and he breathed (*Wanley's Wonders of the Little World*, p. 10).

"An analysis of the process discloses no element in a voluntary action which is not to be found in an involuntary action, except in the origin or degree of stimulation" (*Phy. Bas. Mind*, p. 373). The action in both cases is that of "a neuro-muscular mechanism which works in the same way, whatever be the source of the original impulse" (*Ib.*). The fact of having to learn to do certain things (*e.g.* reading and writing) which afterwards may be unconsciously performed, shows that the *voluntary* and *involuntary* are merely expressions of the conscious and the unconscious.

Lewes says, Descartes, through likening vital mechanics to the action of a machine, became misunderstood, and thus men were led away from the special conditions of the machinery: he admits animals have sensation, perception, emotion, and memory, his denial of their having souls practically amounts to the ordinary position that animals have not thought or consciousness of self; the admission of sensation is quite enough to mark the essential difference between an organism and a machine (*vide ib.* 382).

It is unnecessary further to pursue the details; if what has gone before does not show the distinction between machine actions and those of the vital organisms, it is useless to adduce other evidences. Huxley's paper in the *Fortnightly* (No. 95, 1874) is so subtly written, that but for his reply in the end of the article to attacks made on him, it would be difficult to assert that he positively held the idea that men and animals are automatic. It seems rather an anomaly to say, "We are conscious automata endowed with free will in the only intelligible sense of that much abused term, inasmuch as in many respects we are able to do as we like!" The only question "is whether the doctrine be true or false?" Lewes, with his usual vigour, has canvassed the position, and, as I think, has shown that vital energies differ from machine impulsions, and thus, by cutting away the foundation he topples down the edifice. "*We can conceive an automaton dog that would bark at the presence of a beggar, but not an automaton dog that would bark one day at a beggar, and the next day wag his tail, remembering the food the beggar had bestowed.*"

The automaton hypothesis appears but as the phantom of a thought, startling for the moment, and, like a vision, is obliterated through its own insubstantiality. If in man there be but the simulation of intelligence, where else in nature are we to find a fact?

The Darwinian theory is denounced, and the assertion is made that the sequences of the changes are not produced. If one chain of sequence were established, it is fair to assume as the knowledge of palæontology increases, the difficulties environing the subject will vanish. In the sequel we shall find there is one chain of evidences so perfect that reasonable doubt cannot assail it. The hoofed horse, the most useful servant of civilized man, has grown to be what it is from a five-toed creature. Any one denying the theory of evolution who has not acquired knowledge by his own observations or by experiment, or by collating and verifying in some way the experiences of others, commits an insipience, and does not thereby controvert the position which he, in his assumption, assails. It were *the very wantonness of irony* to call him even a paper philosopher. It is true bone for bone (as a general proposition) may be found in all animal organisms, but no merely anatomical knowledge would disclose that the plasma spot had the potence to become a perfectly organized man. This, the greatest of all physiological facts, is unquestionably shown. The perceptive power in such a conclusion is completely at fault, and quite a different apparatus is called into action before the consonance of the plasma spot with the animal skeleton is arrived at.

All organisms present the same fact. The time was, and even is, when the motor speck is indistinguishable, whether pertaining to an animal or vegetable organism, showing the same origin, with an after divergence through development; by which we have man, and the perfected vegetable form. There is no materialism in all this, and we can say with Agassiz or with Goethe, that we have the objective presentment of the primæval thought. Notwithstanding the comprehensiveness Huxley claims for Biology, its work is strictly pathological and anatomical; and when by an induction he assumes for mind an organic origin, he travels out of his score. When these limits are exceeded we arrive at a ground common both to *the paper philosopher* and to the Biologist, the knowledge of one being then exactly that of the other—empirical, with the difference that the paper philosopher deals with abstractions. The office of the biologist is with perceptive results, and when in his zeal he extends his researches beyond his science, possibly he may confound the ideal with the physical.

Huxley tells us "that the foundation or rudiments of almost all the faculties of man are to be met with in the lower animals; that there is a unity of mental faculty as well as of bodily structure, and that here also the difference is of degree and not of kind." How large is the significance of this word *almost?* We have a sorry illustration given to us, as a difference "drawing or modelling." To me it seems in animal constructiveness both are rudely delineated. How many are the examples in animal economies which the high science of Lubbock could more pertinently adduce. For instance, the water spider forms beneath the water a water-tight cone, from which she empties the water by carrying down globules of air, thereby constructing a natural diving-bell, and affording a secure and fitting receptacle for her young.

The trap-door spider hollows a cylinder in the earth, and encloses the aperture with a lid, which *hinged*, she opens and shuts at pleasure, and can so tightly secure that from without it can only be opened, the creature being within, by the exertion of force. Such instances as these might have a pertinent bearing on the discussion, were they individual and not tribal acts. The only possible argument, as I understand the subject, for "foundation and rudiment," as proving the identity of animal instincts and the human mind, is found in sensation as exhibited in consciousness; it *may* be argued that sensation by development becomes abstract mind. Man has the instinctive or perceptive mind of the animal, here all likeness ceases; he has also the abstract or conceptive mind in the largest sense of the word, and this no animal shares. It is these little confusions which excite the nervousness of those who build their beliefs on faith, and who feel it incumbent on them to deny the whole premiss from the feeling that if a basis be formulated the material pinnacle will appear. If we accept proved facts and draw, with "the carrier's horse, inferences in reason," none would go far wrong, and we should, as Cooke says, avoid on the one hand "the rocks of materialism," and on the other "the incongruities of idealism." If thought-out facts were transfused into other minds we should meet with less infirmities in thought, and get at association and disassociation, then we should perceive our facts, conceive our inferences, and disclose the antecedent. Organism by development tends to one more and so does mind also, for development discloses the *purposeness* of both in the scheme of creation. Death, as we call it, makes the line of divergence, and whatever the ultimate, no act of ours, however possibly it may modify, can alter it.

Paper philosophy, in its true use, is as good as science facts personally obtained. If the paper philosopher accepts the facts of the physicist, then the facts for the purpose of argument are exactly the same; the one knows them by experiment, the other knows them as an acceptance of concurring authorities. Even our able Huxley himself was greatly indebted to paper science, before he became an adept in experimental science (this he appears to admit); and so are all men who ever arrived at eminence. If we were all confined within the bounds of our own experimental knowledge, however arrived at, the realm of science would be much shrunken, and would be a worse Babel than it is, for even now no two men agree on all facts, and when we arrive at principles and inferences, the uproar and clamour is universal.[1]

What is the teaching of Evolution? Embryology shows the minuteness of organic changes, comparative anatomy presents the facts of the matured organism, but all variations are initiated in the fœtus. We may have the perpetuation of organic facts as patches, freckles, and horny protuberances, and other such surface variations, and also in form, as six fingers. The grand gradations of the distinctions of form, the changes of scales into hair, and of hair into feathers, are not the accidents of organism, but the adaptation of organic forms to suit changed conditions, and these changes are the progressive steps marching with the inorganic. In the era when the surface of the earth was sterile rock and water, when the diatoms, polypes, and the algæ represented organic life on the earth, it was impossible land animals could have existed, and ages may have elapsed before the spores of the first creatures presented the line of divergence (vide *Dallinger and Drysdale's Experiments*). If the "*plastide*" balanced between plant and animal development, it (if the doctrine of evolution be true) was the first presentment; whether a creature or a spore, it had the potence within to develop into the complex variations of animate forms; and it is probable the first animal life after the "jelly blob," had its representative in one direction in worms and unclothed slugs, and in the other in plants, at all events, vertebration was first represented (so far as yet known) by the Ascidian and Amphioxus. The worms may probably have been preceded by the infusoria, from which may have developed the parents of that we know as animal life. Much has been unravelled; much is the merest conjecture. It is unnecessary further to repeat that which has been already dwelt upon. It does not follow because the initiatory steps are not known, as following the worm into the starfish, or the lancelet into true vertebrates, that therefore the theory is untrue. To follow Huxley:

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[1] When it is insisted upon that knowledge can only be derived from observation and experiment it would practically *thrust all but* the most accomplished experimenters outside the range of science. Who, but by long years of study, could arrive at the microscopic precision of Beale? Even accomplished microscopists are at times deceived. It was confidently asserted that typhoid fever was due to the growth of a microscopic fungus, as also was the elephant foot of the Malabar coast. T. R. Lewis and D. D. Cunningham, investigating the textures of the so-called "fungus foot," discovered that the fungus-like appearances arose from the medium used in mounting their subject for the microscope. Creighton, inspecting the supposed fungus form of typhoid, came to a similar conclusion, and found the fungus a myth. Such facts must necessarily deter beginners, who must doubt their observations, *when the most experienced are liable so signally to fail.* Is the skill of Huxley or of Beale in microscopic anatomy to be attained before a decision is pronounced? That men should know the meaning of facts by observation and experiment is a good guide, but a greater certainty is attained by accepting the concurrent testimony of accomplished observers as to the facts. As to the inferences to be drawn (the facts adopted), all are on equal ground, *else we founder in dogma.*

The hoofed horse is a toed animal, as anatomy discloses. "To any one who is at all acquainted with the morphology of vertebrated animals, they show that the horse deviates widely from the general structure of mammals; and that the horse type is in many respects an extreme modification of the general mammalian plan." "The general principles of the hypothesis of evolution lead to the conclusion that the horse must have been derived from some quadruped which possessed five complete digits on each foot," &c. "Seven years ago, when I happened to be looking critically into the bearings of palæontological facts bearing upon the doctrine of evolution, it appeared to me that the *Anchitherium* and *Hipparion* and the modern horses constitute a series in which the modifications of structure coincide with the order of chronological occurrence, in the manner in which they must coincide, if the modern horses really are the result of the gradual metamorphosis in the course of the tertiary epoch of a less specialized ancestral form."

We shall, in the sequel, see how truly the conclusions of this great evolutionist were verified. In a period anterior to Huxley's illumination we had the pig, the rhinoceros, the tapir and elephant, as allied to the horse, and although there was supposed to be sufficient evidence to convince a naturalist of this unity of construction, yet it was not such as would convince the uncultured outer circle. When Huxley announced that the hoofed horse was derived from a five-toed creature, and waited for evidence, the opponents of the theory of evolution derided the thought as an unfounded assumption, and yet the proof of the assumption is now complete. The five-toed ancestor has been found (*vide* note 2, p. 98).

From the Pliocene, remains of horses have been found "in all essential respects like existing horses." The *Hipparion* (extinct European three toed) presents a foot similar to the American *Protohippus*. In the late Eocene or earlier Miocene was found the *Palæotherium*, which further discoveries led to be recognised as a distinct genus, *Anchitherium*, differing but little, excepting in the character of the teeth.

The conclusion Huxley arrived at, confirmed by Lartet, was that the *Anchitherium* type had changed to the Hipparion type, and that into the Equine type.

It was accepted as a fact of history that the American continent, before the intrusion of the Spaniards, contained no horses. It is now proved by American geologists that deposits of their remains are as frequent as they are in Europe. In the Western territories these deposits have been found. The researches of Marsh, Leidy, and others, have shown that forms allied to the *Hipparion* and *Anchitherium* are among these remains. So "we must look to America rather than to Europe for the original seat of the equine series." "The succession of forms carries us from the top to the bottom of the tertiaries." First there is the true horse, then the Pliocene form *Pliohippus*, followed by the *Protohippus* (European Hipparion), having one large digit and two small ones on each foot.

Next is the *Miohippus* (European Anchitherium), having three complete toes, preceded by the *Mesohippus*, having three toes in front with a large splint-like rudiment; the *Orohippus*, which is next, has four complete toes on the fore limbs and three on the hinder. "The knowledge we now possess justifies" the "anticipation that when still lower Eocene deposits and those which belong to the Cretaceous epoch have yielded up their remains of ancestral equine animals, we shall find a form with four complete toes and a rudiment of the innermost digit in front, and probably a rudiment of the fifth digit in the hind foot; while in still older forms the series of the digits will be more and more complete until we come to the five toed animal, in which, if the doctrine of Evolution be well founded, the whole series must have had its origin."

These discoveries are principally due to Professor Marsh, who since the above opinion was delivered has discovered a new form, the *Eohippus*, in the lower Eocene, which corresponds very nearly to the expressed anticipation (*vide American Addresses*, pp. 85, 90). It is difficult to know which to admire the most, the scientific prediction or its consummation.

The progressive development from the lizard into the bird formation is traceable, although the links of change are not quite so positive as in those of the horse. The change also of the salamander from a water to a land creature (the change of gills into lungs) is almost complete; a few details are yet wanting. Wilder theories are broached as to the change of land mammals into sea mammals. The links from the ox to the whale may be more difficult to accomplish, purely from an absence of materials on which to work. From all that has gone before, the links probably will not be of the change of land mammals into sea mammals, but through the fishes and the gigantic saurians of the geological eras. Such consecutive evidence lifts the theory of evolution from the region of hypothesis, and presents it as the delineation of the fact of formative creation. It is for objectors to vary or upset such evidences, and until this is done, the theory of evolution will brave all "winds of doctrine." "Knowledge of every kind is useful in proportion as it tends to give people right ideas which are essential to the foundation of right practice, and to remove wrong ideas, which are no less essential foundations and futile mothers of every description of error in practice. And inasmuch, whatever practical people may say, this world is, after all, absolutely governed by ideas, and very often by the wildest and most hypothetical ideas, it is a matter of the very greatest importance that our theories of things, and even of things that seem a long way apart from our daily lives, should be as far as possible true, and as far as possible removed from error" (*Study of Bio.*, S. K. Museum).

CHAP. VII.

THE KOSMOS.

WHAT IS THE KOSMOS?—LEARNED IGNORANCE—GERMAN MATERIALISM—ULTIMATE KOSMIC CONCEPTIONS—THE CENTRAL SUN—ASTRONOMICAL KNOWLEDGE—ANCIENT CULTURE—ASTRONOMY—A SPECULATION ON ULTIMATES—THE SOLAR SYSTEM—SUN SPOTS—THE PROMINENCES—METALLIC RAIN—NEBULÆ—PLANETS—COMETS—METEORS—THE AURORA—TERRESTRIAL MAGNETISM—REICHENBACH'S HYPOTHESIS—THE HEAT OF THE INTERIOR OF THE EARTH—THE OYDLL—THE DEAD EYE—THE SPECTRUM ANALYSIS AND INCANDESCENCE—LIGHT AND FORCE MATERIAL SUBSTANCES—THE CONSEQUENCE—SOLAR PHYSICS.

THE Kosmos has its scientific representation, in Astronomy (*stellar bodies*), Geology (*world formation*), and Biology (*animate forms*). The divisional, yet homogeneous results every where existing in the phenomena constituting Nature are due to the interaction of principles which are universally present. Vitality and Heat (as the expression of force and matter), and Intelligence. To man all would be as though they were not, but for Consciousness, the passive recorder of sensations and thoughts, wherein they are delineated as forms are on the surface of a mirror. In Kosmic presentments forces are the mediate agents, the immediate factor *being the cause as expressed in intelligent direction.* Comprehensively it may be said the Kosmos as a phenomenon is the Universe, and the Universe the creature of a thought; hence, as the presentment of a conceptive intelligence, it has the conception interfused in it. Thus the nucleus of the germ, however it arose, however it was interposed, became the representative of the originating thought and the formulator of the Kosmos, and contained within itself the capacity to be, because freighted with the thought from which it emanated, and as self-contained has the potence of ingeneration and differentiation. All things are the manifestations of an intelligent direction, hence out of Intelligence all organized forms arose, and it necessarily follows that Intelligence in its individualism, self-contained, of itself filled that the finite knows as universal space with the grandeur of its own Infinitude. The conception of the Kosmos, because originating in principles, can only be divined by principles, effects being but resulting consequences.

Throughout the Kosmos is found direction, *i. e.* the subservience of all things to an unvarying law. That which is directed is the *casual,* that which directs the *Causal,* hence the Universal subsists in the Intelligence from which it emanated. The reasoned deduction would be, that as direction is individualized in Intelligence, that also which is directed and governed originated in a primordial substance; developed as force, it becomes condensed into that we know as matter; that is to say, all the diversities we know as forces, and all the differentiations we know as material distinctions had their origin in one primordial element; thus the generalizations of Grove, Malpighi, and Darwin find their primordial or elemental origin in heat, for that only from its derivation is universal and unchanging; as an organized substance, is vitalized by the intellectual energy from whence all originated. The finite exists in divisional differentiations, the Infinite in an individualism eternally prolonged. In this eternal individualism we find the *Provident Cause*[1] wherefrom the Universe arose, by which it was concentrated, and in which it exists. Shall we not say this Infinite intelligence, individualized in its own substance, out of which all objective forms flowed, and in which all are contained, the provident director of all phenomena as contained in its own energy, and from whence they all emanated—*is the one sole cause or in the emphasis of its expression*—GOD. In this conception there is no room for the proteus matter as a separable quality, nor unless individualized can it become as spirit; mind as the finite expression of intelligence, possesses in itself both quantity and quality, and as unchanging in principle, in development it becomes spirit, *i.e.* an entity; thus as an individualized particle it returns to its origin, and has an eternal existence because of the Eternity of its Origin.

The construction of the orb on which man lives is the only key by which he can unlock the mystery of creation. The secret which research discloses, and which "does not for a moment admit of doubt," is that the whole of phenomena is connected "by a rigid chain of cause and effect admitting of no exceptions" (Helmholtz). The boast so loudly heralded of the progress of science shrinks into a knowledge of infinitesimals arrived at through a minute analysis. Principles elude research; only the outer barriers in which nature is shrouded have been surmounted, and these but partially; when the demand is made that the unknown should be interpreted by the known, at least a known should have been presented which contained nothing of the unfathomable and unknown. In this spirit the hypothesis is presented that matter is ALL BEING and itself the *Eternal;* this is the fallibility of the finite—a speculative dream which fades like the shadow in a zenith light.

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[1] Collectively, a providence surrounds nature in the sense of a superintendence. We find order and design. Whether there be that called "a special providence" attending each individual is another aspect of the same question. Faith answers affirmatively, but philosophy finds no clue to such a result; it may be, a concurrence of circumstances leads to such an idea, but how shattered it becomes in the garb of its facts. A, B, C, and D join in a water party, the boat is upset. Colloquially it is said A and B were *providentially saved,* were C and D providentially drowned? Many are the instances on record of what appears to point to special providences. In my youth I knew a lady, the daughter of a clergyman, who when a child prayed she might have a set of child's tea things given her; the next day she received such a present from an unknown donor. For ever after she believed in a special providence and the efficacy of prayer. She lived a long and utterly uneventful life. Parnell's "*Hermit*" is considered to contain the philosophy of special providences. There is the presentment, but no philosophy could unravel the intricacy of the machinery employed.

Learned ignorance is a grand invention, *the sleep awake school;* it rules and has ruled men in all ages of the world. How many are the books written in the wisdom of ignorance. The materialistic theory involves incongruities impossible to reconcile; who could conceive a thinking and moving amorphous mass of carbon or thinking and self-active gases? Are we to pause when physics are resolved by physics, and hold them to be results having no antecedent impulser? In all phenomena, philosophically viewed, there are significancies which shatter the material problem; the shadowings of the imponderable and eternal, whereby "the carpentry and chemistry" of nature, are resolved into intelligence as the primordial factor. Scientific Materialism is the battle-ground of Theology and Science. If the Kosmos be the infinite perpetuation of a thought its basis must be sought in intelligence and not in matter, although the perceptive presentment be matter. The mandate placed on man is to labour to disclose the unvarying laws through which nature is accomplished, till then "he dare not rest satisfied, for then only can his knowledge grapple victoriously with time and space and the forces of the Universe" (Helmholtz).

The Darwinian theory, controversially perverted by the Materialistic leaders, has given a reasonable explanation of the organizations of life, and more, it has lent its aid to the emancipation of thought, whereby a juster conception of Deity in relation to Kosmic ideas has been attained. The theory must be contemplated in its simplicity—the wondrous and too frequently absurd hypotheses with which too zealous investigators have clothed it, must be disregarded. In the same way as Religion has been crowded by grotesque hypotheses, so has the development theory been enlisted in aid of speculative incongruities. Whether the rampant aspect of material imaginings is due to the antagonism of thought excited by the hypothesis "that being has arisen out of not being" (Hegel), or whether from some spirit of hostility to Theological teachings, is not clear. On the death of Hegel there was a rebound which has thrilled through and tinctured German opinion. Schopenhauer took the lead, and insisted that all philosophy which had held men in sway from the then time to that of Kant was mere "university charlatanism." Heine, in "the lispings of the time," saw that materialism would take the place of a more wholesome train of reasoning. He wrote, "we have grown out of Deism, our latest philosophers have proclaimed thorough Atheism as the last word of German philosophy."[1]

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[1] The *Times* reviewer of works on German materialism says, It is useless to try to hide the anti-religious character of much of this literature; but no one can afford to shut his eyes to this grave characteristic of German speculation. Atheism is written on many pages of this materialistic literature; not a timorous Atheism which speaks an esoteric language, but one which comes out in the open, displaying its menacing form with effrontery, speaking its mind roughly and freely—an "Atheism active, militant, angry, intolerant, and fanatical. It addresses not merely professors and men of science; it speaks the *patois* of the common people." To Büchner, Hellwald, and Max Shultze Religion in any form is the Bastile of the human mind. "God did not create the world," says Büchner, "but the Theist created God." Hellwald says, "The task of science is to destroy all ideals, to manifest their hollowness, to show that belief in God and religion is deception, that Morality, Equality, Love, Freedom, Rights of man are lies, and at the same time proves the necessity of all these errors for human devolopment." Haeckel indulges in speculations which go to show "that each cell in a living organism has its soul." What, to put at once a leading question, is man? The reply of not a few seems to be, a bucket of water and a few pinches of phosphorus. What is thought? "Thought," says Moleschott, "is a movement of matter;" without phosphorus no thought." "*Geist* and *Seele*," says Haeckel, "are only higher and combined or differentiated powers of the same function which we speak of in the most general way as force, and force is a general function of matter. We know no matter not endowed with force, and, *vice versâ*, we know no forces which are not connected with matter." Matter is almost deified. "Motion and matter," says Büchner, "are alike eternal." "All our life," Vogt somewhere observes, "the life of all organisms, the whole telluric and cosmic life, is built on the principle that matter remains eternally the same." "Matter," says Wiener, "is and always has been eternal." No mercy is accorded to teleology in any form. How was the world created? "Purely through physical and chemical forces, without organic substance, without a known Creator, nay, without a leading idea, the world exists" (Vogt). What is the purpose of the world? "The laws of nature," according to one answer, "are rude, inflexible powers, which know nothing of morality or pity." "The search after a cause for the world," says Büchner, "is like going up an endless ladder." Richard Schuricht—who, if he writes ironically, is no coarse caricaturist—will not allow men the satisfaction of believing that they are the subjects of fixed, necessary laws; that is not quite correct. Nature does, indeed, conduct her operations according to immutable, inflexible, determined laws; but the collocation of the forces of Nature, to use an expression of Dr. Chalmers, their relation to each other is accidental. Necessity is, therefore, only a special case of chance. Man, the world, all that therein is, is but the product of an accidentally existing universe—one of the bubbles on the surface of the ocean of Being which will by-and-bye burst. "Robinet speaks of plants as sedentary animals, and our relation to all that lives is emphasized by speak-

Feuerbach, once the pupil of Neander and Schliermacher, adopted Hegelianism, turned his back on Theology, and at last was landed in a pronounced Materialism. He wrote, "there is no safety (*salus*) out of philosophy," and ended by writing, "my philosophy is no philosophy." His ideas gained many imitators, not a few of whom formulated their postulates on scientific bases. Vogt held the soul was a misnomer for functional purposes, and dies with the organs. Büchner, that Force and Matter were the Bible of German Materialism. Schuricht's *Journal of a Materialist* is Materialism "naked and unashamed." Haeckel asserts each cell has a soul, a theory so caustically adverted to by Virchow at Munich. Schopenhauer says, "No one who really philosophises can be religious;" in answer it may be said, that no one who truly philosophises but must be religious.

What is Religion? If it be answered that Religion is the deep appreciation of a Divine energy working around and within us, and which to man is what the design and purpose that underlies Nature is to Nature, in such a retrospect Theology, being but the science of an idea, can have no place, it has grown out of all proportion, and has an existence only through customary acceptation and the absence of reasoning. When natural facts are canvassed, Mechanics and Chemistry are found, and whatever be their character, they are the fruits of intelligence as manifested in design. Man like Nature is an incorporation—Matter and Intelligence—dual as phenomena. All technical adaptations, whether of art or of nature, are the result of intelligence; the idea of the artist is embodied in his picture, can we say otherwise than that the Factor of Nature is embodied in his work? If with the finite and limited there is intelligent direction, can we deny this intelligent direction to the Infinite and limitless? In the finite there is an embodiment, what is this embodiment but the personification of thought? All phenomena are judged in their presentment as form, the symbol representing the thing;

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ing of man as a speaking ape." Hartman "is consistently and thoroughly pessimist. The world itself stands self-condemned. The life of man is more miserable because more intelligent than that of the higher mammals; theirs is worse than that of the oyster; and the best existence is that of unconscious matter." The German phase of materialism is thoroughly gloomy, it has none of the buoyancy of French materialism lighted up with hopes of "human perfectibility." Schuricht, although a materialist, says, "Materialism springs from a conviction based on an experience that every effort is a failure, and that our position is a comfortless one." What we know only diminishes our illusions, and "with the lost illusion goes the lost pleasure." "The dying Goethe exclaimed, 'More light.' Not so we. We perish in that excess of light which modern physical science sheds on the burning question of the day. More to be desired by us would be that twilight in which thought cannot thrive, and in which Phantasy can find fit food. 'My blindness give me back again my sense of darkness and of joy.'"

hence forms and symbols are the representatives of the thought by whose energy they were conceived, with this distinction, that in the finite the work falls short of the conception, whilst in the Infinite it is always realized; thus intelligence becomes personified in its fact, judged as an effect; hence intelligence is a Creator; further neither Philosophy nor Science will carry us. With cultured man, by the force of the religious sentiment the ideal is realized, and the creative intelligence, infinite in adaptation, becomes God. With uncultured man, superstitions taking the place of the ideal, the dream of the unknown becomes a terror or a dread. The uncultured man personifies his superstition in the same manner as the cultured man personifies his ideal. When man goes beyond a simple conception of Deity it is an outswelling of finite perceptions to infinite proportions; and when he invests the conceptions with attributes, whether of good or of evil, superstitions arise through trespassing on the regions of the unknown. The sense of Religion may be summed as reverence and duty; intelligently conceived, it humanizes the creature, and teaches the abrogation of *the self*, by which only those equities can be assured which are due to other men. Call the sentiment what we may, Religion, Morality, Philosophy, it is that rule of conduct first enunciated by *the heathen* Confucius, which teaches that men should do to other men the like of that he expects from them—in other words, "do unto others that which they should do unto you." Had the professors of creeds practiced this golden rule of humanity, the world had never been amazed by an unreasonable materialism. Theologies are based on *a priori* assumptions, and probably there is as much unreality in the varied creedal hypotheses, as there is in that of the Materialist who presents matter as the *perfected* ALL. What has been the gain to man by national Theologies? We may draw the curtain over this dark page of historical recital, and say its object and end have been the enslavement of man for an idea. More evidences can be adduced in favour of the conception that Intelligence is a substantial reality, than can be adduced in proof that matter *per se* has any existence; at its best, matter is but the symbol of an underlying principle. What is the gain in the denial of a Personified Intelligence? Do we speak of a thought in a sense of a personification? No! Yet there never was a thought conceived but which in some sense is personified either in some objective form or in the *Ego* which conceived it. To understand the Kosmos we can only conceive an embodied intelligence as its commencement, its object, and its end; and "*the living and visible garment of* GOD" *but as the expression of* HIS *thought.*

Galileo and Kepler[1] were the precursors of Newton, but he by analysing the motions of the planets, came to the conclusion that every particle of ponderable matter attracts every other particle with a force varying inversely to the square of the distance, and promulgated his law of gravitation, whereby astronomers have been enabled to guage the firmaments of suns, and to recognize the operations of this law even in the movements of the double stars. Galileo began with the study of terrestrial gravity; Newton hesitatingly extended the theory to the moon, and it was not until a degree had been carefully measured by Picard that he announced his decision and boldly applied it to the planets.[2] A great step in the knowledge of physics was attained when it was found that rest or motion were indifferent, and that either continued until other forces intervene. Kant and La Place independently conceived that the space now occupied by our sun and his system was once filled by an incandescent mist, which by condensation became the sun and his satellites. If in respect of our system such a state existed, that which we conceive to be space was once occupied by a rotating fire mist. The law in its principle is the same, whether its energy be expended on a particle or on a sun, or on the astral system as a whole. Whether such a state ever existed must be the merest conjecture. The assumption is that suns are surrounded by incandescent vapours, flaming hydrogen, nitrogen, &c. All this is said to be confirmed by the spectrum analysis.[3] There is no doubt all is the result of a law universal in application. That a mist impregnated with heat, latent, and sometimes partially positive, is possible, but if a universal conflagration ever existed whence was vitality? whence intelligence? (*Vide ubi supra.*) We have heat in electrical and in magnetic affections, we also can have both without the manifestation of radiant heat. The evidences deduced from nature rather point to vitality than to incandescence as the origin of phenomena:—

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[1] Kepler taught that atoms attract atoms directly as to their masses inversely in the ratio of the squares of their distance. His law of planetary motion was that the orbit of a planet is an ellipse, the sun being one of the foci; and he announced, as a fundamental principle, that every particle of matter will rest until it is disturbed by other particles. Galileo held that every body will persevere in a state of rest, or of uniform motion in a straight line, until it is compelled to change that state by changing forces. The laws of motion known as Newton's are—"*First*. Any cause which alters or tends to alter a body's state of rest or of uniform motion in a straight line. *Second*. A change of motion is in proportion to the impressing force, and takes place in the direction of the straight line in which the force moves. *Third*. To every action there is always an equal and contrary action."

[2] Lagrange said Newton was fortunate in having had the system of the world for his problem, and had no idea that his solution was final.

[3] The general propositions of the spectrum analysis are based on the theory of the emission of light rays from incandescent bodies; this is mainly due to the nebular incandescent hypothesis and the conception that heat as heat is directly emitted from the sun. Personal sensation certainly favours the idea, but personal sensations as to physical facts are not always scientific definitions. By what principle in science can it be shown that sun heat should differ in action from the laws governing heat as explained by science. If the heat in the sun were such that its radiation could be felt at a distance of ninety-two millions of miles, the sun itself would be vaporized through the intensity of its incandescence, and would present no compact object for

> Helmholtz says, "even now we discern in the distant region of the firmament nebulous patches of light, the light of ignited gases—hydrogen and nitrogen. Within our system are distinct traces of matter dispersed like powder, which moves by the laws of gravitation, and is partially retarded by larger bodies and incorporated with them. Attraction impels such bodies to approach each other and thus are condensed and incessantly become smaller. A motion of rotation originally slow became quicker, and by the action of centrifugal force masses would be torn away and which would continue their courses, separated from the main mass, forming themselves into planets with satellites and rings, the principle mass being condensed into a sun. This nebulous chaos must have contained all the store of force which in a future period unfolded its wealth of action. The force which on earth exerts itself as gravity acts in the heavenly spaces as gravitation" (*Prop. Sci. Lect.*).

Thus we have rings, and suns, and worlds whirling in immensity, obedient to a law which ties them all, rotation within rotation, suns and their trains sweeping around other suns, systems of suns rolling round other systems of suns in concentric orbits; and if it be true that "the central mass condensed itself into a sun," to this all the others must be subservient. Aristotle said, "all that moves causes us to look for the cause of the motion we perceive, and it would be but an endless derivation of causes were there not a primary unmoving power."

From records and traditions, ancient nations long before the Greeks were a people, appear in many particulars to have attained an exact astronomical knowledge. Smyth says that many assumed to be new astronomical discoveries were known to the ancients. Diodorus casually mentions that the Druids possessed a tube by means of which distant objects appeared to be drawn nearer, and the only instrumental evidence of the ancient world regarding

vision. The law regarding heat is that the sensible effects of the radiation of heat diminish with the square of its distance. If sun heat be reflected directly as heat to the earth, why is the menstruum through which it passes intensely cold? This is also contrary to the proposition that added temperatures produce only an equalization. All this is no denial that the energy of the sun produces the heat manifest on earth; but this energy is due to magnetic and electrical properties. As the knowledge of magnetism and electricity advance they will probably produce as great a change in Kosmic conceptions as an advanced geological knowledge did when it swept away the catastrophisms with which the science was infested. It is more probable that the sun has a greater similarity to the planets composing his system than to the igneous phantom which now rules the scientific conception. The sun rules the whole of his system. If by heat, what is the portion Uranus receives? If by magnetic laws it is easy to understand the harmonious relations. If the spectrum proves any thing it proves light to be a material substance, and that light is but the polar properties of substances composing it in a state of the extremest tenuity.

optics is the crystal found among the ruins of Nimroud. The Assyrian tiles[1] (3000 B.C.) have the record of a people, the Accadians who came from the East[2] and taught astronomy and science. Piazzi Smyth, in his mention of the Pyramid of Gizeh, says that the position and passages are arranged with an astronomical precision which only could have arisen from an exact knowledge of the motions of stellar bodies, and must have been the fruits of long-continued and repeated observations. The exactitude of position was probably necessary to mark the recurrence of the religious festivals at a time when the sun and the heavenly bodies were considered to be the symbols and types of the divine energy and were objects of adoration.[3] Diodorus Siculus speaks of the Hypoboreans, who had discovered mountains in the moon like those of the earth, to which Apollo went once every nineteen years (allegorizing the observation that the moon in every nineteen years completes and recommences her cycle of phases). Apollonius, speaking of the Chaldeans, said they call comets travellers which penetrate far into the upper celestial spaces, the period of whose return they were able to predict. In the early ages it is probable that many deified names concealed an astronomical meaning. The myth of Brama is one of them. In every thousand divine ages (every one a day of Brama) fourteen Menus are invested with the sovereignty of the earth, and each Menu transmitted his empire to his sons during seventy divine ages. The explanation may be found in that the equinoxes go forward fourteen days in each thousand years and that the days in the period make up seventy-one years. If the astronomical explanation be true, it points backwards to a period of time long anterior to that of any tradition. It is scarcely probable the myth could be so accurate unless it were founded on absolute knowledge, the complete cycle for the precession of the equinoxes being 25,870 years.

The tropical year is obtained by taking from the sidereal year; by the precession of the equinoxes it being found that the sun arrives seven minutes too soon, and thus, unless adjusted, would create confusion in the periods of the festivals and the seasons. The first year merely meaning a succession of the seasons, Halliburton suggests if the first year was sidereal, regulated by the Pleiades, the assumption would include great astronomical knowledge, therefore the conclusion must be that the years and seasons had changed ages before the idea arose that the recurrence of the seasons was connected with the stars, and then most probably the Pleiades were selected and its changes observed and noted. The point of observation being once determined, the gradual precession of the seasons would have been remarked, and have led to the correction by observing the apparent position of the sun. It is to be remarked that the disposition of the passages in the great pyramid show a balancing of stellar and solar periods (Piazzi Smyth); thus the pyramid stands the imperishable record of a knowledge of the past.

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[1] If the misused and broken tablets of Assyria, more than 5000 years old, are but copies of others which had nearly perished, what period is to be assigned for the originals preserved with care, but which had mouldered by the crumbling effects of natural decay? These perishing records, were they originals, or were they copies of those of a remoter antiquity?

[2] The book of Zoroaster, said to be the oldest of the astronomical records, speaks of a summer day as being twice the length of a winter day, which shows it was compiled in lat. 49°.

[3] The great sphinx at Gizeh represents Harmachis or the sun on the horizon, and was set up by Thothmes IV, who was devoted to the worship of Ra (the sun). Amenhetp IV carried the worship of the Disc to its extreme limits and persecuted all other forms of deities except the purely solar gods. The disc is considered to be the same as Amon—Ra, the creative power of the Deity and the creator and ruler of Time (Birch).

In Hindustan and Egypt, the year was made to commence in November, but a collation of the calendars shows it must have been the 17th of March, and that corrections were made so as to keep the Pleiades rising at sunset on a named day of their year, which shows it was sidereal. In Egyptian records this can be traced to 1335 B.C., in Indian records to 1306 B.C. The Siamese have two forms, the Sidereal year beginning in November, the Tropical in April.[1] The four stars of the Chinese and the Persians, which were said to watch over all the rest, Flammarian says evidently refer to the equinoxes and solstices, but that now they have no such place in the sky. By turning the Zodiac 60° Aldebaran,

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[1] Ancient Egypt had 360 days for the year reckoned by months—with five days added. Of this there ~~is~~ was a symbolic representation at Acantho, near Memphis. A perforated vessel was filled each day by a priest, of whom there were 360, the charge of each being one day. Something similar was instituted at the tomb of Osiris, round which were placed 360 pitchers, one of which each day was filled with milk. The tomb of Asymandyas at Thebes was surrounded by a circlet of gold, a cubit broad, and 365 in circumference, on which was inscribed the rising and setting of the stars and astrological predictions. The reckoning the year as 365 days would still be more than a quarter of a day short. Thus the first day of the year would go gradually through the seasons, and at the end of 1460 solar years there would be computed 1461 civil years, and the cycle would again commence. A more accurate cycle was obtained by multiplying 1461 by 25, making the cycle 36,325 years.

The Babylonians divided the year into lunar months, with an intercalary month when Icu (*aldebaran*) was just in advance of the Sun, when he crossed the vernal equinox and was not parallel with the moon until two days after the equinox, shorter months of a few days each were added to keep the calendar correct. The ancient Persians had 365 days; the extra hours, &c., were left unnoticed for 120 years, when an intercalary month was added. After 1440 years, the intercalary cycle, the series commenced anew. The Greeks gave 354 days for the civil year; at the end of eight years they added three intercalary months, of 29 days each, the phases of the moon being thus brought in comparison with the rotation of the earth. Melon discovered a cycle of nineteen years: when 235 lunations have

Antares, Regulus, and Fomalhaut, stars of the first magnitude 5000 years B.C., would be found nearly in the right places. The Indians have also a tradition that there are two stars diametrically opposite which pass through the Zodiac in 144 years and 180 years; the sums multiplied with each other give nearly the period of the cycle of the precession of the equinoxes.

Josephus claims great antiquity for astronomical knowledge. He says, "God prolonged the days of the Patriarchs before the Deluge that they might perfect the sciences of Geometry and Astronomy which they had discovered," and which they could not have done had they not lived six hundred years, because it is only after a lapse of six hundred years that the great year is accomplished. Cassini says this is the most remarkable fact of ancient lore discovered, for if we take the lunar month to be 29 days 50 mins. 36 secs., we find 219,146½ days, making 7421 lunar months, and this gives 600 solar years of 365 days 5 hours 36 minutes. Flammarian doubts the pertinency of Cassini's remark, and says had the number been 19 instead of 600 (*vide* note, p. 319), it would have shown long periods of observation; 600 might apply to many cycles.

The Zodiac[1] appears to have been a most ancient institution.

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occurred the full moons return to the same dates: the year and lunations are nearly as 235 to 19 (433 B.C.). Romulus made the Roman year ten months, Numa added two, thus it was only 355 days. Confusion in consequence ensuing, a supplementary month was instituted. The priests having charge of this complication neglected the duty, consulting their own convenience or the interests of their friends; so summer fêtes came to be held in autumn; that of Ceres when wheat was in the blade; of Bacchus when raisins were unripe. Julius Cæsar reformed this by adopting the solar year and intercalating a day every fourth year. The civil year of the Julian calendar is 365,25, the Tropical year 365 and decimals, so it is short 11 min. $\frac{83}{100}$. To remedy this the Gregorian form was invented, making 97 leap years in every four hundred years instead of the hundred of the Julian calendar. By this means the civil and tropical year nearly coincide; to find it, if the numbers without the ciphers are divisible by four it is leap year, 1900 would not be leap year, 2000would. In 1500, in Germany, the 1st of January began the year; in France, in 1563; in England, 1751. Before this period Easter day began the year. In 1750, in England the first day of the year was the 25th of March.

[1] The most ancient peoples of which history speaks had a knowledge of the Zodiac, and in Egypt it is frequently found depicted on the bottoms of the coffins. The Zodiac of Dendorah (800 B.C.) has more signs than are now recognised. The early nations of Asia usually had 28 signs. The Chinese (1110 B.C.) called the Zodiac the yellow way, and divided it into 28 parts or mansions, and named each sign from the brightest stars appearing in them. The apparent motion of the sun they attributed to the stars in Taurus. The Chaldeans had only 12 signs, and called the Zodiac the ecliptic, or yoke of the sky. The Siamese 27, one of which was called Abegitton, or the intercalary moon. The Arabs had also 28, taking as signs the horns and belly of the Ram. The Persians 28, afterwards reduced to 12; the signs were designated by letters, beginning with the Lamb and ending with the Fishes. They had also a Zodiac for the Moon, and pictured both the Solar and Lunar Zodiacs on coins. Eudemus of Rhodes, says Ænopides of Chio (456 B.C.), introduced a Zodiac of 12 signs, the Scorpion being afterwards added.

La Place says the names of the Zodiacal signs were not given by chance. The Bull as the sign of the vernal equinox would date from 2500 to 5000 years B.C. The balance marked the equality of the days and nights more than 15,000 years ago and matches with the climate and agriculture of Egypt. In a sepulchral chamber in Thebes (Egypt) a zodiac was found having the Bull's head as the commencing sign, and also in a pagoda in Elephanta (*Salsette*). The Egyptians deified the signs: The Ram—Jupiter Ammon, The Bull—Aphis, The Twins—Horus and Harpocrates, The Crab—Annubus, The Lion—Osiris, The Virgin—Isis, The Balance and Scorpion (Scorpion)—Typhon, The Archer—Hercules, Capricornus—Mendez or Pan. Aquarius (the waterer) is found in many Egyptian tombs. The names of the months were those of the animals who accompanied Isis in the festivals. The dog being the symbol of Annubus was the commencement of the year (Flammarian).

Lucian says it was from the divisions of the Zodiac that animal worship became so common in Egypt. Other writers attributed animal worship to the policy of one of the early kings, who appointed a creature to be worshipped as an emblem of unseen divinity by the denizens of each city, in order to prevent that unity among them which would have been subversive of his despotism. The consequence followed that the creature deemed a holy emblem in one city was an article of food in another; by this institution superstitions were engrafted which bred animosities, and thus prevented the union of the citizens for political purposes—craftily making an idea of more importance than the substantial benefits which would have arisen from their association. The same idea in a different form is apparent among modern nations. None hate so deeply as the ignorant when enslaved by an idea. Creeds answer the purposes of demarkation by the excitation of the basest and most abhorrent of all human passions—*Fanaticism;*[1] in the frenzy of its dictates, neither sex, blood-ties, nor moral distinctions are respected—the result, the enslavement and demoralization of peoples.[2]

Palæontologists point to arrow-heads, clipped flints, &c., as evidences of the antiquity of man's residence on the earth. In the astronomical lore of the ancient world, so long a dead science among western nations, is an evidence that prehistoric man was not the unintellectual savage he is so frequently depicted to have been. It is idle to suppose that only within 4000 or 6000 years man was the intelligent creature he is now found to be. If astral cycles of 25,000 years were matters of observation, it goes far to show not only that there have been cycles of civilizations but also cycles of science, and it may be that the scientific knowledge of this time was exceeded by the denizens of the buried continents over which oceans now flow, and that these astronomical dicta were preserved by traditions based on truths and perhaps are but relics of perished peoples. If the knowledge of the astronomical cycles which appears to have been possessed by ancient nations is more than guess, we have a period of knowledge, by many additions, exceeding that period which history assigns to man as possessing the power of intellectual abstractions. In this view it is possible Suleiman and the pre-Adamite kings with their attendant genii were traditional allegories of knowledge and power and, it may be, the dwellers on the earth had compassed a knowledge, thousands and thousands of years before the so-called historical era, and far exceeding that pourtrayed, or which science conceives.

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[1] The union of devotion and chivalry proved more attractive than solitary fanaticism (hermits, monks, and ascetics). "Enthusiasts who might have shrunk from the pilgrim's staff seized eagerly the sword and grasped at the dear privilege of being men of violence in this world and certain angels in the next" (*Crescent and the Cross*). Warburton, in a note, says: "Plenary indulgence was granted, not only to the Templars and Hospitallers, but to every Crusader; none ever required it more, or made a more liberal use of the immunity" (17th ed. p. 244).

[2] "The Mohamedan faith is strictly Unitarian; the Prophet is only prayed to as an intercessor." Moslem once, Moslem ever is a proverb of the Greeks. His very being is identified with his faith; it is interwoven with every action of his life; it is the source of all his pride, hope and comfort. Among us, too generally, our

Greece is assumed to be the cradle of Science, but when Gizeh first bared her naked sides to the heavens the Greeks were hordes of savages, or at the best tribes spread over a few square miles with a fenced village as the capital. If the treasures disinterred at Mycenæ (as plausibly suggested) were not relics of art pertaining to the people, nor the tombs those of Greek kings and Trojan heroes, but of predatory Scandinavian chieftains, it mars the evidence the discovery was supposed to give of the artistic conceptions of ancient Greece. Around Greece were higher civilizations which abounded in a deeper knowledge. If traditions are to be relied on, Pythagoras learned both from the Gymnosophists and from the Egyptians. Thales and Plato both visited the columns of Hermes, and are said to have returned enriched with mystic lore obtained from the priests in the Temples of Egypt. Wherever the Greek obtained his knowledge he preserved the record and bequeathed it as a legacy to the future ages. Thales (*ob.* 548 B.C.) is said to have calculated eclipses, and Pythagoras (*ob.* 497 B.C.) had a great knowledge of solar physics, but the while there existed in surrounding nations a more subtle know-

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religion is of our life a thing apart; "with the Moslem it seems to be ever actualized." "He despises the Protestant, whom he calls prayerless. He looks down on the Roman Catholic and the Greek as idolators" (*Crescent and the Cross*, pp. 51 and 64).

ledge than that to which they had attained. In philosophy high and bright names belong both to the Greeks and the Romans, but when all is said, probably they were but imitators and commentators, not the initiators of their particular sciences.

It is said that astronomy,[1] from its nature, must remain in hypothesis; yet whatever the hypothesis on which the system is based, it must be granted, that the consonance of motion is due to the universality of the governing law, and hence arises the assumption that the planetary and the whole astral system was once a connected mass with uniform motion; unless so, it were impossible that one law could subserve the whole design; at least this explains why in our system all the planets move in the same direction around the sun, and why all rotate in the same direction around their axes, and why the plane of their orbits and those of their satellites coincide.[2] Astronomy is divisible into three periods, the observations of apparent motions and the discovery of real motions, the laws of planetary revolutions and the causes of those laws. As knowledge advanced the *genii* of Kepler gave place to the *vortices* of Descartes, which in turn yielded to *the central force* of Newton (gravitation). Newton said, "The assumption of action at a distance may be made to account for anything." It is the office of philosophy to inquire for ultimates, however infinite in time they may be; as by thinking of their possibilities correct conclusions are arrived at. How frequently assumptions, which at the first blush appear to be absurdities, pave the way for the attainment of great truths. Who but by demonstration would have believed that the observation of two lines in the spectrum of light would have been the means of unfolding the constituents of the sun, the planets, the fixed stars, comets, and nebular mists, or that an observation of the oscillations of the chandeliers in a church would, through their swing, have disclosed the principle by which the astral systems are held in their places, or that the accidental contact of a magnetized spatula with the limbs of a dead frog would have made known the metallic bases of the rocks, or a method by which intelligence could be conveyed from world's end to world's end in a few moments of time, or that sounds could be audibly interpreted at great distances.

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[1] The symbolic meaning of the Titanic myth is that the forces of the Universe and the order of nature depend on the union of heaven and earth (C. Müller) Fourier considers that "the temperature of the ether through which our planetary system ranges is due to calorific radiation from all the bodies in the Universe," *i.e.* the sensible fact of heat, is due to a friction of the particles, in other words, electrical action. "The world of sensible phenomena reflects itself into the depths of the world of ideas." Similarity in movement with the spectrum aid subjects astral bodies to man's intelligence. Uranography is limited to the conceptions of volume, motions only being revealed to the senses. The determination of its curvature gave the measure of the magnitude of our orb, which Pliny termed "a point in the immeasurable Universe." "By the vibrations of the pendulum we are able to conclude that the equality of the temperature of the earth has been maintained; the unchanged velocity of the earth's rotation furnishing the measure of its mean temperature." The insight into the *length of the day* and *the heat of the globe* leads to a knowledge of the thermic condition of the earth. The velocity of the rotation depends on her volume; if cooled the axis of rotation would be shortened, and a decrease of temperature would be accompanied by increased velocity of rotation and diminished length of day. Since the days of Hipparchus, more than two thousand years, the length of the day has certainly not diminished by $\frac{1}{100}$ of a second; we know therefore, that the mean of the temperature has not altered.

[2] "The five principal phenomena of the solar system are—*First*, the motions of the planets are in the same direction and nearly in the same plane; *second*, the satellites are in the same direction as those of the planets; *third*, the motions of the rotations of these bodies and also of the sun are in the same direction as the motions of their projections and in planes very little inclined to each other; *fourth*, the small eccentricity of the orbits of the planets and the satellites; *fifth*, the great

The incandescent mist theory[1] is accepted by Science as the

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eccentricity of the orbits of comets, and their inclinations at the same time being entirely indeterminate." (*Systeme du Monde.*)

La Place assumes the permanent regularity of the motions of the solar system, and adduces as its fact that the orbits of the planets are nearly circular and nearly in the same plane, and the motions all in the same direction, viz. from west to east, and in orbits of small eccentricity and slightly inclined to each other, their secular inequalities periodical and included in narrow limits; so they will only oscillate about a mean state and will never deviate from it, except by a very small quantity. The ecliptic will never coincide with the equator, and the variation in the inclination cannot exceed 3°. (*Sys. du Monde.*)

The smallest planets have the largest eccentricities, and when new planets are discovered which have a greater eccentricity the masses are also smaller. If the rule was inverse, *e.g.* if the orbit of Jupiter were as eccentric as that of Mercury, the stability of the planetary system would disappear (*Whewell*) La Place says—"We ought to believe . . . that a primitive cause has directed the planetary motions." Whewell says—"The laws of motion alone will not produce the regularity which we admire in the motions of the heavenly bodies." (*B. T.*, p. 169.)

[1] Saporta, basing an hypothesis on the speculations of Heer (on the assumption of the incandescent hypothesis), presents a theory of the cooling of the earth, commencing at the Poles, hence making them the first inhabited spots on the earth. (Buffon's hypothesis)—Commencing from this period he assumes that the termination of the Azoic period coincides with the cooling of the waters to the point at which the coagulation of albumen does not take place; that organic life appeared not in contact with the atmosphere, but in the water itself; and he holds that at the North Pole, or near it, there only life was productive, that is in latitude 50° or 60°, or beyond it; and in illustration, instances that the oldest and richest fossiliferous beds occur in these latitudes; that the Silurian formation occurring in the north extends as far south as 25° north in Spain and America, but that the most characteristic beds are found in Bohemia, England, Scandinavia, and the United States; that the Laurentian rocks have their highest development in Canada; that the Palæozoic rocks are north of the great lakes of America, and appear in Baffin's Bay, Greenland and Spitzbergen; that it is the same with the Upper Devonian and Carboniferous beds before the coal formations, extending as far north as 79°; and citing D'Archiac, holds that the coal beds are continuous northward, and become exceptional south of 35°, hence he concludes that climatic conditions were not everywhere favorable for the formation of coal deposits. He asks when the Polar regions were inhabited by the same species as Europe, whether they could have been exposed to conditions which turned their summer into a day of many months' duration, and their winter to nights of a proportionate length? A temperature so equable as to favour the growth of cryptogamic

Kosmic explanation by which Suns and Worlds grew into being. Gravitation as a correlative force is equal to Kosmic emergencies, as an isolated force, but passively expressing weight or a pressure to the centre. If we conceive the Kosmic energy to be vitality, the secret of organization would be found in an expansion from the centre; and if, as is held, there be but *one rigid law* which (however diverse in action) rules all phenomena, it is no assumption to say that every particle of substance whose sum constitutes the Universe is vitally indued, and that the law which made the Kosmos a unity is universal, then the diversities we know as inorganic construction and animate organisms are but differentiated sequences arising from principles and forces instituted and marshalled by law. And when we seek the tie-bond of the astral system, in *the force which links star with star*, *the mediate cause of their heat and light* is the effect of the same law expressed as magnetical and electrical action, which alone fulfil the required conditions, originating in the polar power of the primordial substance. The consolidation and disbanding of substances is synchronous in act,[1] repulsion (centrifugal), and attraction (centripetal) blend—a single action arising through an antagonism, beginning and ending in each other, and thus inducing rotary motion, a single principle in infinite adaptation, for when there exists the impulsive rush there also exists the elastic repulse. When expressing the unity of law we can say, with the author of

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plants appears, he says, incompatible with the alternations of a long day and a long night, that equability, even in high latitudes, may be effected by fogs, due to the warm southern oceanic currents, such as occur in the Orkneys and in Bear Island, 75° north, rendering their summers cool and winters mild—the fogs preventing terrestrial radiation. In aid of his hypothesis, he suggests that during the formation of coal the sun heat was not distributed over the globe as it now is, because the sun had not arrived at its present state of condensation. In the Miocene, he says, there were in the Polar regions a profusion of genera which now are rarely found north of 40°, according with the theory of Asa Gray, who twenty years ago showed that the representative elements of the United States' Flora were previously denizens of high northern latitudes, and were driven south by the glacial cold. Thistleton Dyer has an hypothesis of plant distribution the reverse of Saporta's, and his method is entirely different. Saporta, looking to the past, assumes that the Flora were more localized, more specialized, and thus more harmonized with the conditions to which the earth in early periods has been successively subjected. Dyer, on the other hand, looking to the present, makes it appear that the Flora in affinity and specialization are in harmony with the conditions to which they must have been subjected during recent Geological time on continents and islands, the configuration of which being much as are now found on our globe (*Abridged Farewell Address, Sir J. Hooker, Pres. Roy. Soc.*, 1878).

[1] Should men in the progresses of their researches discover that the phenomena now classed by them under the heads of *attraction* and *repulsion*, although apparently opposite, are really closely allied . . . they will not have discovered a new cause, but a new resemblance (new to them) among phenomena, and will only have advanced one step further in perceiving the simplicity of Nature (*Synopsis, Arnott's Elem. Phys.*).

the *Vestiges of Creation*, "the tear which falls from childhood's cheek is globular through the efficacy of the same law of the mutual attraction of particles which made the sun and the planets round" (2nd ed., p. 24), or with Tyndall, "that the force which rounded a tear had its action on a planet." [1]

In mechanics, two balls in motion striking a third at rest exactly at its opposite poles, no change of position would result, because of the equilibrium induced by the opposing forces, but if this central line were not exactly hit a spinning motion would occur, with a disposition (the force acting unequally) to fly off at a tangent. Rotary motion becomes orbital through a continual indraught to the centre (*vide* Le Sage's *Theory of Gravitation*, p. 216). In illustration may be adduced air currents, which always flow towards a common centre. This motion is also seen in the whirlpools, in water running through a funnel, and in "dimples" or eddies in rivers, the motion being relatively swift at the centre and slower at every movement towards the circumference.

To speculate on ultimates, in synthesis we have phenomenal nature, in analysis the incandescent mist, in its genesis motionless, the velocities by which we are surrounded being but an aggregation of the primal rotating impulse, orbital motion arising through the attenuation of the primordial substance, caused by its continual rotation; thus would arise a bulge at the equator and a flattening at the poles. Thus ring after ring might fly off from the outer circumference which, when severed, would still rotate around the parent mass, and by inequality of cohesion would break up, and through central action the severed portions would assume a spheroidal form and rush around the central mass with a rotary movement on its own axis. The disintegrated portions would be subjected to similar action, and would in turn throw off rings, and give rise to systems with rotary and orbital motions, and thus there would arise suns and their systems and astral systems. The original motion pervading all the separate masses, in all of them there would be the tendency to fly away in a straight line, but which would be restrained by the pull of the parent mass. Although all motion is a continuation of the primal motion, there is what is called an antagonism of force, repulsion or extension, and attraction or gravitation, or a pressure to the centre. Thus, strong in its central point rotary motion continues; weaker in the extremes of the circumference of the original mass it becomes orbital motion.

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[1] To account for the constitution of the Universe we hear of elemental uproars, clashings, collidings, oscillations, and "the rythmic play of Nature," as though creation was "a confusion worse confounded," and from whence accident alone produced orderly arrangement. What can be the conception of ultimate purposes, when, as a scientific exposition, we read, "that ages ago the elemental constituents of our rocks clashed together and *produced the motion of heat*, which was taken up by the ether and carried away through stellar space. *It is lost to us for ever* as far as we are concerned!" Is it not more probable "that this clashing of the elemental constituents of the rocks" was produced by the interior action of an ultimate unit, which not only caused the rocks to be, but through which also was instituted the motion whereby the collisions of these elemental constituents arose? The unit of force was *no creation* of the clash, but the creator of the clash. Were the heat *carried* away and *lost* for ever (in a material perception) in what would the unity of the Universe, where a particle is a necessity to every other particle, consist? The "motion of heat" is conceivable in phenomena as the action of a force, but if it be "lost to us for ever" it would make the mystery of creation utterly unintelligible.

Comets are supposed to have no rotation on their axes; their course, an elongated ellipse, is probably due to the extreme tenuity of the substance of which they are composed, gravitation being exerted as the merest cohesion. If Tait's electric theory be combined with that of Huggins, viz. "that the spectrum of a comet may be justly regarded as that of carbon," and with Reichenbach's magnetic postulate of light, and Tyndall's proposition, that light is never apparent unless it has some material particle to reflect it, it is possible that in the comet we view the first process of the Kosmic condensation of heat permeated by its conditioned facts, electricity and magnetism. In this view flaming photospheres may after all only be magnetic flames, bearing in their volume the properties of the substances from which they emanated, and light, instead of being an undulation of the ether, is matter in its extremest state of tenuity, the luminosity the effect of the polarization of the incalculable myriads of myriads of particles which go to constitute a ray. If Reichenbach's theory of the magnetic luminosity of substances be true (and it seems to be supported by the spectrum analysis), then light itself is in the substance. This position granted, it would show that in the earliest historic ages man had not only attained to a knowledge of high scientific and Kosmic results, but also that he allegorized it in his creeds. The scientific correctness of the creative command (Gen. i. 3), "Let there be light" can be conceived. Light then became the presentment of objective forms, light consolidated as substance, presenting phenomena iridescent through an internal action.

Tait's idea, if I read it aright, is that comets are accompanied by an electric repulsion, barely balanced by an electric attraction, drawn powerfully towards the sun in concentric, elliptical, or parabolic curves, and only prevented from falling into the substance of the sun by the elastic spring or the revulsions of their atmospheres, in other words, by polar properties, the positive and negative, magnetic or electric facts. Through electrical action by the presentation of the poles, we sometimes have a manifestation of vivid heat, and when in combination with magnetism (electro-magnetism), a cone of flame is raised, of so intense a heat that in the arch diamonds are *dissipated*.[1] In the aurora, an electrical or magnetical phenomenon, coloured flames and an intense white light are seen, but without any manifestation of heat (*infra*, p. 351). The flaming prominences occasionally seen in the outer envelope of the sun, whatever their height, sometimes dispersed in a moment, suggest that they are magnetic effects. This view receives support from the different appearances the corona of the sun presented in the eclipse of 1878 (observed in America), and that of 1868 (observed in India). If the sun be but substances in a state of incandescence, its appearance would be always the same. The differences in the appearance of the corona at these periods would be quite consistent with the theory of magnetic emanations,[2] but not with an incandescent theory. In considering gravitation as a correlative force, many Kosmic difficulties are got rid of. If the scientific idea be true that there is no force independent of other forces, gravitation is a correlate force and may be transmuted into electricity, magnetism, or motion. Collectively (as has been argued) they are conditions of a general and universal principle (*heat*).[3] Thus phenomena having their origin in heat (*active or*

[1] Davy showed that a Leyden jar could be charged with voltaic electricity. After describing the battery with which he made the experiment and the formation of an arch by the electrical ignition of pieces of charcoal, he says, "When any substance was introduced into this arch, it instantly became ignited; platina melted in it as readily as wax in a common candle; quartz, the sapphire, magnesia, lime, all entered into fusion; fragments of diamond and points of charcoal and plumbago rapidly disappeared and seemed to evaporate in it, even when the connection was made in a receiver exhausted by the air-pump; but there was no evidence of their having previously undergone fusion" (*vide* note, *p.* 18, *Tyndall's Notes on Elec. Phe.*). The same effect is said to have been produced by Cosmo de Medici III by exposing a diamond beneath a Tschirhausen lens. In some form or other carbon appears to be the base of all organized substances. Is it the unit of matter in its first objective form?

[2] That the heat of the sun is magnetic appears to gain countenance from the experiments of Naccari and Bellati on the phenomena produced by the passage of electricity on rarefied gases. It was shown in some cases that the action on the galvanometer was due solely to the direct action of the magnet of the coil. And in an experiment to determine the heating effects in the neighbourhood of the electrodes, it was found where the electrode was negative about eight times more heat was developed than when it was positive. It is also said that during the aurora borealis the intensity of the scintillation of the stars is remarkably increased. This would appear necessarily to result if the aurora be due to magnetic action, and that whether the aurora be a solar or telluric effect.

[3] Prout, speaking of electricity and magnetism, says: "These energies, as we are acquainted with them, are probably merely accidental and peculiar modifications of the real energies, which in their elementary form may be something altogether different and quite unknown to us." "The forces of gravitation, *inertia* and attraction, appear to be associated, and reside in every individual *atom* of matter in the

latent) are continually reverting to the primordial substance. Heat is universally present, latent or negative in the cold of space, positive or active when elicited by friction, and it may be said through the motion of the molecules, although always present, their motion is but a manifestation of heat. As all the planetary bodies are magnetic there is a double action, attraction and repulsion, always at work. The sun as a magnet would be both positive and negative, now attracting, now repelling, positive as regards his system, but he with his associated suns careering on their way to complete their cycle, are probably all negative to that Sun, which controls the motions of the cycle. The rule, whatever it be, which rules a planetary system rules also cycles of suns, constituting but a part of a greater cycle, cycle following on cycle, each sun of a cycle would be positive to its own particular system, but negative to the greater cycle, but all suns of cycles would be negative to the great positive centre around which all revolve. If the nebular hypothesis has any meaning, all suns, cycles of suns, and astral systems must be dependent on one common centre, the energy of all being but the interfused energy begotten by the great positive centre. Energy implies will, *i.e.* the transposition of will into force, thus the energy of the universe is but a reflex of the great central power, out of whose energy *all being* arose. The Kosmic ultimates have thus far been deduced on mechanical, or, it may be said, by a material method, but whether the great central nucleus is called God or a cause, we fall back on Aristotle's unmoved but primal mover; call it the providence of the Universe, it is the vital intelligence we know as God.

In this presentation we have no *capricious God*, at the circumference of every wheel, the prime mover cannot escape us; all then becomes the ultimate presentment of the primal fact consistent in every impulse, the concentrated perfection of Mechanical and Chemical energy; and so intimately connected is wheel with

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Universe." "The polarizing forces, on the other hand, are evidently dissociated, and reside in different parts of the same mass, hence this mass can in no instance be a mathematical point (or atom), but must consist of at least two equal parts; hence also, as all matter appears to possess polarity, matter must exist in the state of mass or molecule, each of which molecules must occupy actual space. Thus the forces of gravitation and polarization are quite distinct. The forces of gravitation are probably primordial and co-existent with matter; while the forces of polarization have more of a derivative or resultant character, and are evidently subordinate to those of gravitation. The question naturally arises—Are these different forces related to one another? Do the forces of polarization consist of gravitation in a state of separation, or do they result from the motion of the molecules on their axis? (*B. T.* pp. 46, 47). Grove's correlation of forces (in the sense of transmutation) answers the question. "The motion of the molecules upon their axes" could not occur without the action of heat, and if all the forces be but the resultant conditions of heat, gravitation and all other forces are consequences of the principle, heat.

wheel, that the machine presented for contemplation is homogeneity and order. So precise is every movement and every consequent formation, that the mightiest combinations have no more providence attending them than have the minutest particles. The *providence displayed is that grandeur of thought presented as a Universe;* and in the infinite diversities, appropriations and condensations of particles constituting the *great whole,* is found the workings of an Infinite intelligence; and in this exposition there appears to be ample room for spiritual possibilities. Call all this speculation or what you may, it is clear, whatever the primal factor whereby the primary motion was first instituted, this primary motion in the infinite diversities or transmutations of conditional force would keep the planets in their places in the solar system, and suns in their places in the astral system, and each cycle as it revolves within its cycle in its place; for all stellar bodies are but links in a chain, "interwoven in a web of mutual relations, subjected to one pervading influence, extending from the centre to the furthest limits of the great system." [1]

Both Helmholtz and Mayer must have imagined the possibility of gravity ceasing on earth and being resolved into heat.[2] They calculated the amount of heat which would be evolved on a sudden stoppage of the motions of the earth, by which it would be resolved into an incandescence, and be precipitated into the sun. By the enunciation of this theory they must have conceived that gravitation could exist, when gravity, excepting as elemental heat, had ceased to be. Pendulum experiments show that the attraction of gravitation is determined solely by the quantity and density of matter.

The solar system consists of a Sun and the Planets (including the asteroids, in number 191),[3] and their Satellites or Moons

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[1] Comte calculated the rotation of the solar masses and arrived at the conclusion "that rotation extended in every case to the actual sidereal revolution of the planets, and that the rotation of the primary planets in like manner corresponded with the orbital period of their secondaries." The theory gains depth when it is found the multiple stars have a "revolutionary" motion around each other in ellipses.

[2] The Astronomer Royal (Cumberland), speaking of the nebular hypothesis, and assuming its truth, says: "The condensation would produce enormous heat, and thus account for the heat of the interior of the earth." Spectroscopic analysis shows a variety of materials in planetary compositions. The density of the earth is 5½ times that of water, the sun only one of water. What the sun was he could not tell, "but it is a very light creature indeed." As to the earth, his conclusion was "the high and prominent parts of the land are made of something light, and the heavy and dense parts are those covered by a considerable quantity of water which have sunk deep into the central lava on which all things are resting!"

[3] Science has rejected for the asteroids the theory of an exploded world; yet in the history of Biela's comet there is warranty for such a supposition. We have not in the disintegration of a comet the disintegration of a world, but of the nebulous matter of which, science tells us, worlds were formed, then the law being as imperative

(20), Aerolites, Nebular Mists, and Meteors. The Sun the centre of energy by which their motions are controlled, immense and magnificent as he appears to be, filling our firmament as with an individual power, is yet but a particle of that immense immensity termed the Universe. So great is the distance from sun to sun, that the Sun and his dependent train, if viewed from the nearest of the fixed stars, would appear but as a streak of light, a confused diffusion, a nebular mist. It is computed a ray of light from the nearest of the fixed stars travelling with its reputed velocity would continue its course three years before the transit was arrested by the earth. The diameter of the sun is 852,380 miles, the volume 1,245,000 times that of the earth and 720 times that of all the planets, their satellites and all Kosmic particles interspersed in his system. He moves through space five miles in a second of time, and rotates on his axis in twenty-five days; his distance from the earth is computed to be 92,093,000 miles. A railway train travelling thirty miles an hour would require nearly 347 years before it could complete its journey from the earth to the sun. Pythagoras, who really may be esteemed the father of western astronomy, supposed the sun to be distant from the earth 44,000 miles, Aristarchus, of Samos, and afterwards Ptolemy, Copernicus, and Tycho Brahé, computed it at 4,800,000 miles. The most eminent astronomers since have attempted the solution of the problem.[1] The sidereal cluster to which the sun belongs is surrounded by two rings, one very remote, the nebulous milky way, the other composed of stars of the eleventh and twelfth magnitudes, to which the term milky way is also given (W. Herschell).

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in the particle as it is in the mass, in the contemplation of science the fate of the magnificent Sirius, or of the solar system, might be that of Biela's comet.

The last four of the asteroids were discovered (1878) by Prof. Peters, of Hamilton College, Clinton, N.Y., who appends the dates of their discovery, and has given them the following names: No. 188, Menippe, June 18; 189, Phthia, September 9; 190, Ismene, September 22; 191, Kolga, September 30.

[1] The difficulty in arriving at astronomical precision is shown in the various attempts made to define the distance of the sun from the earth. Kepler, after studying Tycho Brahé's parallax of Mars, concluded that the sun was at least 13½ millions of miles distant. Cassini worked the calculation more exactly, and assumed it was not less than 85,500,000 miles. Locaile at the Cape and others in Europe reduced it to 82,000,000. By an observation of the transit of Venus, 1761, it was increased to 94,500,000. In 1796 other observations were made at various stations. In 1822 Encke made the distance 95,274,000 miles. Hanser, from the tables of the moon, gave the sum as 91,739,000; Le Verrier computed it to be 91,330,000, corresponding to a dimunition of the diameter $\frac{1}{30}$ part. Stone (Greenwich) found an error in this computation which, corrected, made 91,730,000. Newcombe (America), by the same method Le Verrier had pursued, gave the calculation as 92,500,000. By Foucault's experiments on the velocity of light the distance became 91,400,000. Winnecke's statement is 91,200,000. Newcombe, by a calculation of the parallax

It was supposed by Sir Isaac Newton that the rotary and orbital motions of the heavenly bodies originated in the primary impulse received from the hand of the Creator as they were respectively launched into space. This theory predicates the mutual gravitation of bodies and the counterbalancing action of the centripetal and centrifugal forces; but there were difficulties, the bodies were not only attracted by their primaries, but by each other, in accordance with Kepler's laws, no two bodies can interact on each other without immediate contact, unless by the intervention of some potent medium. A vacuum is not expressed by Newton, but it is implied, or he would not have trembled for the stability of his system, as if left to its own internal provisions there were threats of derangement, and "he felt impelled to call upon God to avert such a catastrophe, by supplying from without that which he did not suppose existed within the system." Calculations led to the conclusion that the irregularities and apparently incipient derangements would reach a maximum, and then there would be a gradual return to the condition of primæval equilibrium, and a progressive tendency to react in the opposite direction, action and reaction succeeding each other, so it was conceived that "the irregularities, like the oscillations of a mighty pendulum, would serve to mark the hours and moments of eternity." This conception of the laws of the internal arrangements and movements of the system, with the apparent mathematical evidences which have been arrayed in its support, must be regarded as a triumph of human genius. "Yet even while overwhelmed with a sense of sublimity, one cannot suppress a feeling of sadness as is contemplated its cold and mechanical lifelessness. It is like a machine left, when wound up, to its own action, its maker withdrawing his personal care. Looking thus on the system of the heavens, it is only by a painful stretch of inductive reasoning a

of Mars, altered his opinion to 92,200,000. Stone is supposed to have made the nearest approach to the true distance, 92,000,000—for which he received the Society's medal. This distance was accepted as the true one, with a probable error of 300,000 miles. The distance supposed is that stated in the text. Strange to say, the Astronomer Royal of Scotland, by calculating the dimensional features of the great Pyramid (Egypt), finds for the distance 92,000,000 of miles, and asserts that many of our recent astronomical acquisitions were known to the ancients. The sun's weight Guillemin states to be, in tons, 2,154,106,580,000,000,000,000,000,000. When the questions of velocities and distances, &c., are expressed in sums of figures such as the mind cannot conceive, we may arrive at some conception of them by contrasts. Arago ingeniously suggests a mode by which the distances can be distinctively understood. Suppose the earth to be a foot from the sun, and that this foot consists of 92,000,000 miles, the distance of Uranus would represent nineteen such feet. The nearest star is supposed to be 61 cygni, its distance from the sun would be represented by 138 geographical miles, which reduced into feet gives 67,277,760,000,000 miles as the distance.

conviction can be obtained that there is a cause "connected with its origin."

The system as propounded is full of difficulties, for there are many chances against the maintenance of this actual equilibrium in all the parts of the great whole; if the oscillations did not find their exact counterpoise, the divergence, if but of the fraction of the weight of a planet, even of a single pound, would be progressively aggravated, and ruin would inevitably result. Had the nebular theory been known to Newton, it is probable his system would have been differently framed. Science has proved there is no vacuum in space. The retardation of comets in their orbits in the interplanetary spaces proves that there is an existing and retarding medium.

Let us suppose an apple placed in a microscope of power sufficient to expand its substance to the dimensions of the milky way. Its particles would represent the orbs, planets, and other Kosmic bodies, its pores the interplanetary spaces. The natural order of vegetable circulation would bear some resemblance to the rotary and orbital motions, obeying laws by which the stratifications and compartments of the apple are formed; these would then appear as distinct systems. A Newtonian is introduced. He gazes through the eye-piece, and thinks he has obtained a new view of the internal arrangement of the stellar systems. On being asked his opinion he would say, the principle applicable here is that of the stellar creations; each orb received a mechanical impulse when launched by the hand of its Creator, each orb moves in a vacuum, and would have moved in a straight line for ever, had it not been deflected from its course by an equal and perpetually operating force—gravitation. If one of these revolving bodies were arrested in its orbit and centrifugal force were thus destroyed, gravitation would draw it to the central sun, and this would so derange the equilibrium as to produce a catastrophe. The opinion given, the apple is shown. He then sees the internal arrangements are governed by the vital principle, its recuperating power preserving the equilibrium, and keeping order in all its parts. There is in the universal law no distinction between the great and the small; add vital recuperation to the Newtonian theory and the fears for an unstable equilibrium are dispelled. Each orb is but a centralized force, whose emanations grow more rare on their removal from their respective centres. Thus we have action and reaction; beyond certain distances the interblending forces are harmonious, within the limits attraction would create crowding, reaction interposes and order is restored. Supposing there were a displacement of the equilibrium there would then be an inrush on the primary, increasing with the square of the distance (supposing no counterbalancing forces were developed on the approach), the intercrowding of atmospheres, and the vital action due to the proximity of two such bodies would be called into play, and a repulsion would ensue through the elasticity of the ether, as the rebound of a spring, and the equilibrium would be adjusted; supposing the rebound did not take place, and the body was held in the position assumed without sharing the general motions of the system, it would fester and decompose through the heat of the primary, thus falling back into its former nebulous state, it would be absorbed in its atmosphere, or would be repulsed, and reaggregating in its former position would be re-formed (vide *Macrocosm and Microcosm*). The principle upon which the Universe is constructed manifestly possesses a self-regulating power, the co-ordinated coherence of an almost living organism, exempted from all external causes of death. "Let planets be crowded out of their orbits, if such were possible, and they, by their inherent law, would return again, or a new arrangement would be assumed. Let planets and whole systems be stricken out of existence, there would be an immediate supplying their place, a healing of the parts."

Within less than 300 years the earth was considered as the centre of the planetary, if not of the astral system, rigid and immovable, around which the sun and planets revolved. All this is changed; the Sun, as regards his system, is its moveless centre, and all bodies comprehended in his system move as he moves, and rotate through the energy evolving from him.

In 1611 Galileo observed that there were spots on the disc of the sun; Shribner had independently, and afterwards in association with Helvetius, observed them, and determined they were not of uniform brightness, and were surrounded by a fringe less bright in the centre. In the neighbourhood of the spots Helvetius discovered bright streaks and called them faculæ. The term was adopted by W. Herschell, they are the celebrated willow leaves of Nasmyth, about the nature of which a few years back there was so much contention. They were likened to all manner of things—grains of rice, &c. &c., but are now considered to be inequalities of surface in the envelope of the sun. The peculiarity of their appearance is considered due to a varying intensity of light. In 1769 Cassini announced the spots changed their position, they were supposed to be attached to the sun's surface or to be very near it. In 1769 Wilson observed the nucleus of a spot on a lower level than the photosphere, presenting the appearance of a vast cavernous opening; it passed across the body of the sun and disappeared. It is now known these spots rotate with the sun. The movement is in a westerly direction across the sun's disc in a period of about 25 days 7 hours 48 minutes. They vary in number, size, shape, and appearance, and are subject to periodic changes from *maxima* to *minima* and the reverse. This period, as ascertained by observation, is about 11¼ years, and appears to correspond with the changes of the heat of the earth, the rain fall, and magenetic periods.[1] The spots are almost confined to two narrow zones on either side of the sun's equator, extending from the 8° to the 35°.

Wm. Herschell says, "The sun is the fountain of light which illuminates the world and the cause of the heat which maintains the productive power of nature, making the earth a fitting habitation for man; and that the stars composing the Universe are similar bodies, their innate light being so intense as to reach the eye from the furthest regions of space." He supposed a fiery liquid surrounded the sun; smoke of volcanoes or scum floating in an ocean of fluid matter, and that by its ebb and flow the high parts of the sun were occasionally uncovered and appeared as dark spots. In 1779 he examined a large spot, seemingly divided into two parts, the largest exceeded 31,000 miles, together 50,000 miles. After repeated observations, he remarks (1792), "the black spots are the opaque ground or body of the sun, and the luminous part is the atmosphere, which being interrupted or broken gives a transient view of the sun itself." He considered the sun's atmosphere to be not less than 1843, nor more than 2765 miles in depth, and that the sun had a luminous envelope consisting of luminous clouds floating in a transparent atmosphere, beneath which is another layer of opaque clouds protecting the solid and unilluminated nucleus, the openings in which expose the body of the sun as a dark spot. When the aperture is uniformly large the spot will be uniformly dark, but if the outer aperture is greater the spot will be surrounded by a dusky border, if the upper layer alone is perforated, a dusky spot without any dark central portion will make its appearance. J. Herschell found the spots occurred in zones, and inferred that they were caused by a fluid circulation induced by rotary motion, and assimilated them to movements occasioned by hurricanes and tornadoes in the regions of the solar cyclones attributing their obliteration to the same cause. Schwabe, unwearied in observation, concluded that a certain periodicity marked the recurrence of the spots; that there was a progression from *minima* to *maxima* and the reverse, steady, but not uniform, and that this period is about ten years. Wolff (Zurich) assigned the period as 11·11 years, or the ninth part of a century. This theory was controverted, but is now proved to be nearly right. Schwabe also recognised an association of the spots with the magnetic disturbances on the earth. Lamont (Munich) first, then Sabine, Wolff, and Gautier, observed these magnetic disturbances. Wolff assigned for them the same period as for the spots. Carrington, observing the sun, was surprised by a bright light, as of a sudden conflagration, also seen by Hodgson. Balfour Stuart, taking note of the time, found the magnetic implements at Kew indicated that a magnetic storm was then raging, which was accompanied by a display of Auroras at Rome, in the West Indies, America, and Australia, showing that an association exists between disturbances of the solar photosphere and terrestrial magnetism.

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[1] The very acme of assumption appears to be reached when the sun spots are pronounced to influence commercial crises. This hypothesis is presented by a correspondent to *Nature* (vol. xix, p. 97). The conception is ingenious; he argues that when the sun spots are in the *maxima* the grain (wheat and barley) is plump and full, when in the *minima* smaller. Oats are oppositely affected. The writer concludes—"It is in this direction I look for the cause of commercial depression. . . . Other causes may have some effect . . . peace, war, trade unionism, bank management, &c.; but the influence of the sun is too far reaching and too powerful to be checked thereby. Man, by studying the workings of its influence and power upon his daily life, may learn how to guard against much of the distress which periodically occurs." That the magnetic action of the sun is the proximate cause of the fruition of the earth there is no doubt, and that meteorological effects are due to magnetic influences; at the same time it must be conceded that the improvidence of man and fatuity of social impositions has more to do with human distress than the *maxima* or *minima* of sun spots. We have the science in the philosophical allegory of the plump and well-favoured kine being devoured by the lean kine, and the full ears succumbing to the lean ears of corn.

De la Rue, Balfour Stuart, and Lowey, who made their observations together, agree—*First*, the umbra of a spot is nearer the sun's centre than to the penumbra. *Second*, solar faculæ, and probably the whole photosphere, consist of solid or liquid bodies, of greater or less magnitude, either slowly sinking or suspended in equilibrium in a gaseous medium. *Third*, a spot including both umbra and penumbra is a phenomenon which takes place beneath the sun's photosphere (Dawes saw a facula extended beyond the sun's outer limb). They also think Venus exerts a special influence on the spots and importantly affects the sun's photosphere. Dawes discovered that within the umbra (formerly nucleus) there is a darker region. The umbra is perforated within its centre by a perfectly dark hole, the true nucleus. The dissipation of the umbra Secchi compared to the dissipation of cumulus clouds in the heat of summer. Within the spots he discovered coloured matter, such as that from whence the prominences spring. Lockyer has also recognised the appearance of luminous matter. Schwabe had noticed various tints of red in the spots, as also did Capocci and Schmidt. Dawes detected in some spots a rotary motion, as though they were the scene of a tremendous tornado. In 1843 Schwabe measured a spot 74,816 miles in length. In 1858, in an eclipse, the moon passed over one 107,816 miles in breadth; in the same year another was observed 143,500 miles in breadth. The celerity with which they sometimes disappear is almost incredible. Wollaston saw one burst into pieces "like a mass of ice dashed on a frozen pond." Biela also says they sometimes disappear in a moment. W. Herschell was observing a spot; he turned away his eyes for a moment and it had vanished.[1] Vassenius, in the solar eclipse of 1733, observed several red clouds floating, as he supposed, in the sun's atmosphere. In 1806 Ferrier observed some faint traces, as did Van Swinden in 1820. In 1842 the red prominences were seen. Biela and others saw a border of rose-coloured light. Halley (1715) observed the moon's limb appeared to be tinged with a dusky, yet strong light, and supposed the appearance indicated mountains in the sun; Arago showed that for mountains there was too great an inclination from the perpendicular; Faye considered them optical illusions; the 1851 eclipse proved the appearances were solar appendages. Dawes' description is a red prominence of vivid brightness and of deep tint, with several smaller ones. In 1860 Goldsmidt was present "at the formation of a prominence," *i. e.* the process by which it became visible on the decreasing light; he described that he saw as a chandelier, which on the reappearance of the sun seemed to be in the centre of the moon. Secchi's and De la Rue's photographs proved they were prominences, that they were many in number, and appertained to the sun. His globe appeared to be encircled with flames, some of which were 80,000 miles high.

The eclipse of 1868, observed in India, led to important results. At Guntoor, Tennant procured six photographs. Lieut. Herschell applying the spectroscope obtained three vivid lines, red (hydrogen), orange (sodium), and blue (hydrogen). It was supposed the discovery of these lines would become the means of solving the whole mystery. Jansen saw six lines. He writes: "Immediately before totality two magnificent prominences were apparent, the splendour of one of which it is difficult to describe." The thought struck him that the lines might be obtained when the sun was not eclipsed; the next day confirmed his idea, he saw the lines. Herschell's lines had given the idea, and Lockyer, by means of a new apparatus, saw them and sent his account to the French Astronomical Society, and whilst it was being read Jansen's description, despatched from India, arrived. In 1866, Huggins examined ι in Corona which had suddenly blazed out; it gave hydrogen lines. Other stars had given lines of glowing hydrogen. The accepted view is that the sun's envelope is the glowing vapour of hydrogen. Lockyer has named it the chromosphere (Proctor says the word should be "*chromatosphere*)"; beneath are the photosphere, the penumbra, the umbra, and the dark spot or nucleus.

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[1] The variation of the hydrogen lines in the spectrum is held to be due to differences of temperature; other lines also indicate violent action. The most striking of all are lines due to aqueous vapour, corresponding to those of our atmosphere, Secchi describes them as water lines. Arago concluded the solar photosphere must be gaseous from the absence of polarization at the edges of the sun's disc. This Herschell questions.

In 1869 Zöllner observing the sun, saw what appeared to be electrical discharges rapidly succeeding each other. His hypothesis is, "that small intensely incandescent bodies moving near the surface of the sun emit rays of all degrees of refrangibility." Gilman's observation of exceedingly bright red points in the heart of the prominences confirms Zöllner; "he had been regarding the action of solar eruptive forces casting forth glowing masses of hydrogen gas." Respighi spectroscopically observed all parts of the solar "compass;" he considers "the prominences are strictly phenomena of eruption." One prominence he noticed attained an elevation of 160,000 miles; it seemed to bend back and fall into the sun like the jets of a fountain, and assumed a variety of shapes; gradually the whole sank, sometimes forming isolated clouds before reaching the surface, the whole presentation having very much the appearance of the Geysers in eruption. Mayer observed the eclipse of 1859 from a mountain in Virginia, 5330 feet in elevation, and says, to the unaided eye was presented "a vision beyond description:" "in the centre the black disc of the moon was surrounded by an areola of soft white light through which shot, as from the moon, straight massive silvery rays, seemingly distinct and separate," the whole spectacle "showing as upon a back ground of diffused rose-coloured light." Gilman's coloured spectrum gives four radiations connected by lesser ones, the prominences are apparent, the whole merging in a violet or mauve coloured light. Farrel says of the corona, it was a silvery grey crown of light as if the product of countless fine jets of steam, which were phosphorescent, issuing from behind a dark globe. Newcombe says it appeared as a jagged outline extending into four sharp points, the form being that of a trapezoid. There is but little doubt that the corona is a solar appendage, most probably magnetic emanations, aurora streams from the sun; for the light of the zodiacal gleam gives the same spectrum, and closely resembles that of the sun's corona. Proctor seems to consider the corona and zodiacal light "form a solar spectrum of immense extent," *i.e.* they are identical (*Sun*, p. 577). If all the planetary bodies are magnets and give off magnetic emanations, it follows that each planet shines by reflected and by magnetic light. If Jupiter and Saturn be suns, the theory must extend to Uranus and Neptune; then the outer planets are more closely assimilated with the sun and would constitute a quintuple system. The aqueous lines found in Jupiter's spectrum are no bar to the theory, for the same lines are ascribed to the atmosphere of the sun (*vide* note, p. 337).

The theory is that the sun has an atmosphere about 800 miles in height, above which is the photosphere of molten matter surrounded by the chromosphere of incandescent and glowing materials. The elder Herschell and Arago inferred the probability that the sun was peopled. J. Herschell went beyond his father, he regarded "the true inhabitants of the sun not simply as capable of bearing an intense heat and light, but as themselves emitting the chief part of the light and heat which we receive from the sun." An idea similar to that of Figuier, without the theory of the metempsychosis.

The igneous volcanic action which projected glowing cones and jets of light has given rise to another, called the bubble theory; Young, of Dartmouth College, Hanover, U.S., is its parent. Proctor says, "The sun according to this view is a gigantic bubble, whose walls are gradually thickening, and its diameter diminishing at a rate determined by its loss of heat. It differs, however, from ordinary bubbles in the fact that its skin is constantly perforated by blasts and jets from within." We are further told, "the vapours of the sun's globe consist in the main, we know, of metallic elements, and these condense into clouds composed of minute globules (or, perhaps vesicles of fluid metal), "the rain which falls from them consisting simply of molten metals," as "this tremendous rain descends," the drops "would coalesce until continuous sheets would be formed—and the sheets would unite and form a sort of bottomless ocean resting on the compressed vapours beneath, pierced by ascending jets and numerous bubbles." Proctor says, "In fact, ... we shall find reason for considering Professor Young's theory as affording a very satisfactory explanation of observed appearances" (*Proctor's Sun*). Novel writers are condemned for their sensationalisms. How is the above description to be classed?

The work of the Herschells was gauging the stars' depths. Observations on the remoter stars seem to indicate no change of place; by analogies it is assumed that there are velocities greatly exceeding any known to us. Slowly the conclusion was arrived at that the stars are distributed into systems. W. Herschell first supposed the sun to be a star in the milky way, but eventually he concluded it was an insular star in the plane of the milky way. After measuring all the changes and relative positions of the stars, the planetary bodies, aberrations of light, &c., he found there was a residual annual motion of the fixed stars; the computation included the translation of the solar system and the actual movements of the stars. By a comparison of ancient star catalogues, he concluded that in one quarter of the firmament the stars were drawing together, and in the opposite they were receding, and he conjectured the sun and all his retinue were moving in some grand path towards a point in the constellation of Hercules. In the hands of Argelander, Struve, Peters, and Maedler, this theory of solar motion assumed a more definite form. They re-examined the star catalogues with the view of ascertaining whether there was any district in the heavens where the apparent motion of the stars was such as would infer a central region: such they found in the star Alcyone in the Pleiades. Around this star the sun and the whole system of suns to which he belongs are supposed to be revolving. Eighteen millions of years are required to accomplish a single revolution.

W. Herschell modified his idea of the distances of the stars through observing the motions of multiple stars. His conclusion was, each stellar system is shaped like a flat disc. He found the milky way, to the naked eye hazy streaks of light studded with bright points, to be an extensive stratum of stars. Eventually it was forced on his mind that each point of light was a blazing sun moving in its own orbit, and sharing the motion of others. In 1786, when he began his researches, the observed nebulæ were 150, in sixteen years he described 2500, his son added 2208 to the list. Of the nebulæ now known $\frac{80}{100}$ have been discovered by the Herschells; most of them have been resolved; the others appear to defy scientific appliances; they are described as straggling clusters condensed in central positions, and of all shapes, the spiral, the ring, the dumb-bell nebula, the crab, the key, the flight of wild ducks, streamers, and wisps of cloudy light. He recognised in them galaxies, systems of suns, star systems on star systems, universes within universes. Such are the distances of the stellar spaces that the swift comet which occasionally notifies to us its presence has come from profound depths requiring millions of years to traverse. Our system, the world of our science, if viewed from the nearest of these suns, would appear but as an iridescent streak of light. Contrasting milky way with milky way, we fail to realise the distance separating them. "If it were possible to distinguish between the parts of an indefinitely extended whole, the nebula we inhabit may be said to be one which has fewer marks of profound antiquity than the rest."

In 1811 Herschell writes, a scattering of stars may be admitted in certain calculations, but when milky ways are examined the supposed scattering must be given up and nebulæ may be conceived as clusters of stars "disguised by their extreme distance." Many do not consist of clusters of stars, but of some self-luminous mass of extreme tenuity; some of which he conceived lay within our galaxy. The Magellanic clouds correspond to the milky way in an irregular and medium brightness, but the access to them "on all sides is through a desert."

The planets in the order of their distance from the sun are Vulcan, Mercury, Venus, Earth, Mars. The Earth has one moon, Mars two (late discoveries).[1] Between Mars and Jupiter there is a gap filled with small planetary bodies, Asteroids, most of which have been discovered within the last half century. The outer planets are Jupiter, Saturn, Uranus, Neptune. Watson supposes there is a planet beyond Neptune, of which he is in search (*vide* note 1, p. 58). All the outer planets have moons. Jupiter four, Saturn eight, Uranus four only known, Neptune only one. The moon is said to be a *dead* orb, and has no atmosphere;[2]

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[1] Swift, in his sneer at science, in speaking of the astronomical discoveries of the "Laputans," says they have discovered that Mars has two moons or "satellites, which revolve about Mars, whereof the innermost is distant from the centre of the primary planet exactly three of his diameters, and the outermost, five; the former revolves in the space of ten hours, and the latter in 21½, so that the squares of the periodical times are very nearly in the same proportion with the cubes of their distance from the centre of Mars, which evidently shows them to be governed by the same law of gravitation that influences the other heavenly bodies" (*Gulliver's Travels*, p. 281, *Dr. Taylor's ed.*).

A correspondent to the *Times*, citing from Voltaire's *Micromegas Histoire Philosophique*, calls it a bit "of unintentional prophecy." They coasted the planet Mars, . . . they saw two moons which attend that planet, but which have escaped the observation of our astronomers; whilst philosophers who reason by analogy say Mars, who is so far from the Sun, could not be satisfied with less than two moons. Both Swift and Voltaire may have relied on the idea of Kepler, who surmised that Mars had a moon; this was after the discovery of some of those of Saturn. Swift goes beyond this, and defines the sizes and distances of the moons, which nearly accord with those derived from observation.

[2] Tolver Preston (*Nature*, v, 19, p. 3), says there is physical evidence of the absence of an atmosphere on the Moon; but, according to the Nebular hypothesis, the Moon at some time must have had an atmosphere. He suggests that in accordance with the kinetic gaseous theory, the atmosphere of the Moon has gradually disappeared; as, from the theory "it would follow necessarily that molecules situated in the top stratum of any atmosphere, and which acquire these enormous (indeterminable) velocities, can sometimes overcome gravity and be projected into space so as not to return; as it is a known fact that only a finite velocity is required to effect this result." Why the same consequence has not happened to the atmosphere of the Earth, he attributes to the greater gravity of the Earth, though

the astronomical dictum being, "the time of her revolution round the Earth is also the time of her rotation on her axis." If the moon has a rotation on her axis, how is it that the figures depicted on her face are always in the same position, whether the Moon be at her full or whether in her phases? There are many interesting statistics regarding the moon which reluctantly I am silent upon. Thomson and Tait founded on Moon statistics and a tidal wave theory, their hypothesis of the degradation of Energy, but which (as I conceive) Huxley, in the Geological Anniversary Address, 1869 (*Geological Reform*, L. S., p. 228), has ably demolished. If there were any principle in the hypothesis its application would be universal, not alone the Earth, but the whole Universe would, in Geological eras, become dead and lifeless. If, as Science proves, Suns have been in existence millions of years, they could only exist (*to speak mechanically*) by the energy of vital recuperation. And it may be said, *if there were the possibility of such a collapse, the whole science of astronomy is founded on a baseless hypothesis.*

The outer planets from observation are supposed to be suns, if it be true that Jupiter is a sun, it would follow that the planets beyond him are also suns, and would probably, in Kosmic relations, present a quintuple system. Jupiter is the largest of the orbs revolving around the sun, and whose motion is controlled by the magnetic energy of the sun. His diameter is ten times that of the Earth, his volume 1280 times, his mass only 300 times. He rotates on his axis in ten hours (9 h. 55 m. 26 sec.); his equatorial velocity 7½ miles in a second of time, and his period of evolution about twelve years (11 y. 10 m. 14 d. 19 h.). His moons revolve around him at varied periods. By observations made on the belts of Jupiter a theory has arisen that he is a sun, and that on his surface there rage cyclones of so stupendous a character, that if they occurred on the earth every building would lie prostrate; the solid oaks would be as wisps in the scattering of the storm, and not a ship would survive in the rushing surges of the ocean. A velocity of 150 miles an hour on our planet, in its range, would efface all traces of life. Ordinarily the telescopic Jupiter appears in a state of calm, the pictures drawn have been those of gloom and desolation, and also of a peaceful and

"possibly (for aught we can tell) part of the Earth's atmosphere has thus disappeared." If the Moon rotates on her axis (unless the rotation be inconceivably slow), the pull from the centre would prevent such a contingency. If there be no rotation on her axis, a simple physical experiment would possibly account for the absence of an atmosphere, *e.g.* a vessel filled with water (a pail) swiftly rotated round the head and not a drop of the water would be spilt, but if a gliding movement (as orbital movement), or a very slow rotation be resorted to, every drop of the water would be shed. The water would represent the Moon's atmosphere. Mr. Preston's argument is ingenious, but contains too many suppositions to carry conviction.

sweet serenity. In 1860 a reft in his belt was observed, which astronomers assert indicated the progress of a hurricane. In 1870 the creamy zone of Jupiter assumed an orange tint, with an outline frayed and torn like the edges of storm clouds, and this appearance changed night after night. Lassel was struck by the vividness of the colours of the belt.[1] The equatorial zone was a brown orange, the three neighbouring dark zones purple, and one of the intermediate light belts a light stone-green. Secchi, in 1872, found the equatorial band, rose colour, strewn with a number of yellow clouds; above and behind the band were strongly marked and narrow lines, resembling stretched threads, the blue and yellow being in strong contrast with the red. Proctor says on *à priori* grounds the sun's influence would but little affect the condition of the atmosphere of the planet, and therefore the source of energy must be in itself. "If the belts were sun raised how could they night after night reappear with the same general features?" "If the appearances are to be attributed to the sun the whole matter is unintelligible, but perfectly intelligible if the source of the changes be in the orb itself. If streams of vapour are poured upwards to vast heights, they would be carried into regions where the movements due to rotation would be greater, and would be caught by the swiftly moving upper air, thus heat alone can account for the enormous masses of the clouds of Jupiter being sustained at their heights by a surface intensely heated and would account for the ruddy aspect of the belts." Bond says that he shines more brightly than if he reflected all the light streaming on it. Zöllner that he shines three times as brightly as a globe of equal size would shine if similarly placed, but constituted like Mars, and four times as brightly as such a globe would shine if constituted like our moon; Nasmyth had both Venus and Mercury in the field of his glass, Venus shone with twice the brightness of Mercury looking like a shield of bright silver, whilst the disc of Mercury looked more like lead or zinc; he suggests the difference must be owing "to some very special and peculiar condition of his (Mercury's) surface or envelope, by which the fervid light of the sun's rays is quenched or absorbed before they are reflected from his surface." If the incandescent theory were true, but for some protection, Mercury from his comparative nearness to the Sun would be burnt up,[1] and Vulcan and other inner Mercurial orbs would be little more than floating gases. If the magnetic theory were recognised, instead of incandescence there would be the bright splendour of the magnetic rays, and the colour printed on the spectrum would be that of the substance from which they emanated, thereby satisfying the molecular hypothesis without the interposition of flaming nitrogen or hydrogen, or the rain of molten metal, the consequence of Young's bubble hypothesis.

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[1] On this night the fourth satellite passed. Lassel observed it on its first passage, it could scarcely be distinguished from the edge, but as it advanced it grew darker and darker, and when one fourth of the way across it became very dark, if not black. Secchi says, "I observed the third satellite and its shadow, the satellite appeared almost black when in the middle of the planet's disc, and smaller than the shadow; on approaching the edge it disappeared and then re-appeared as a bright spot.' These observations seem to infer that the disc is smaller than it was supposed to be, and that instead of the small density assigned to it (1¼ that of the earth) the density equals, or exceeds that of the Earth.

The magnitude of the stellar spaces may be conceived when the Earth's orbit of 578,053,662 of miles is but a speck in comparison with that which separates the sun from the nearest of the fixed stars; earth's change of place counts for but little in the tremendous interval, wherein the sun and his attendant spheres are but as a luminous mote. Sirius has a thousand million times the bulk of the earth, with a proportionate velocity, and yet the earth is careering on its way 18·2 miles in a second. Besides the places of the suns and their worlds, stellar space is interlaced by the paths of comets and meteors rushing in their orbits from sixty to eighty miles in the beat of a pendulum. In meteoric systems are evidences of "bodies more massive than suns, and opaque as planets." All stellar bodies have several motions, which, whilst independently pursued, are yet in relation to the motions of other bodies; otherwise there would be inextricable confusion; as it is, each retains its own motion, while it takes on that of its primary; thus the spiral motion is the resulting effect.

Comets are of importance in all Kosmic hypotheses, the more so since Huggins has shown they consist of carbon in extremest attenuation; through the study of them probably will be found the initiatory process of the condensation of matter from a primordial ultimate, through the correlate forces as concentrated in heat, or by the action of heat on itself, as one or other condition is in the ascendant (*vide* p. 326).[1]

The opinions of the ancients regarding comets were vague, as until lately were those of modern astronomers. Metrodorus thought they were but reflections from the sun. Democritus, congregated vapours. Aristotle, a collection of vapours which had become dry and inflamed. Strabo, a splendid star, enveloped in a cloud. Heraclitus, of Pontus, a cloud which gave out much light. Epigenes, some floating terrestrial matter, which had caught fire and was agitated by the wind. Boetius, coloured air. Anaxagoras, sparks of elemental fire. Xenophanes, a motion spreading out of the clouds which had caught fire. Descartes, the débris of vortices which had been destroyed, the fragments of which were coming towards us. Newton, that they were partly composed of solid matter, the gaseous matter alone being affected by the sun's heat. La Place, wandering nebulæ, a confused mass of elements. Voltz accounts for the variation of volume by supposing the Sun's atmosphere exerts a great power of compression, which is most effective in his neighbourhood. Tait assimilates them to swarms of stones, or meteors which are partly illuminated by the sun, and also give out light of their own through numerous and violent collisions, especially when near the sun, where they swarm most densely. Carden held "it was a globe situated in the heavens, and rendered visible by the illumination of the sun, the rays passing through it forming the appearance of a beard and a tail;" "in other words, the tails were mere optical appearances." Roche considered that in their passage round the sun they were disturbed, as they also were by the action of the planetary masses. In the changes comets exhibit, the action of the sun is clearly distinguishable, as in the neighbourhood of its perihelion they are developed on the grandest scale. Tyndall supposes they are actinic clouds, decomposed by solar light, the actinic power tending to effect precipitation, and the calorific power tending to effect evaporation; whilst the former prevails there results a cometary cloud, when the latter cometary vapour. Guillemin does not agree with this hypothesis, as it only explains the visibility of extremely attenuated vapour. Kepler says the sun strikes the spherical mass of the comet with direct rays, which penetrate its substance to form that trace of light, the tail, the rarefied particles of which are driven away and dissipated. Hook said this arose from repulsion, but did not explain how; his idea was accepted by Gregory, Boscovich, Pingré, Delambre, and Laland. Kepler's solution was adopted by Euler, Faye, and La Place, who says, "the tails of comets appear to be composed of most volatile molecules, which the heat of the sun raises from the surface, and by the impulse of his rays banishes to an infinite distance." Olbers says the proximity of the comet to the sun causes a development of electricity in both bodies, hence arises "a repulsive action of the sun and another of the comet upon the nebulosity which surrounds it. By the first theory he accounts for the tails, by the second for the numerous sectors, plumes, and envelopes observed in Donati's comet." J. Herschell says it is not improbable that the sun is charged with positive electricity, and as the substance of the comets vaporises the electricities arise, the nucleus becoming negative, the tail positive. Liäis (*l'Espace Céleste*) favours electric repulsion, the multiple tails and various shapes according with the hypothesis. Bessel's theory is not very different, he compares the axis of a comet to a magnet, one of whose poles is attracted by the sun the other repelled. He considered the sun's ordinary attraction does not explain the vibratory action which seems to indicate polar force, as if "both the cone of light and the body from which it issues were subject to a rotary, or rather vibratory motion in the plane of the orbit."

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[1] Speaking of heat, Prout says: "Various opinions have been entertained on the subject, some considering the cause of heat (caloric) to be an existent and material fluid, though of such extreme tenuity and imponderability as to escape our observation and to become manifest to us only by its effects upon our sensations and upon all the ponderable forms of matter; others consider that it is not material, but a property or principle of motion, which by exciting a certain species of vibration among the particles of bodies, causes the sensations and effects of heat. Such are the most usual opinions, and the probability is that they are neither of them literally correct, but that heat, and we may add light, are substances, the molecules of which are influenced by polarizing forces precisely similar in all respects to those which influence common matter; that is to say, that the molecules of heat and light obey laws similar in all respects to those which govern the molecules of all ponderable bodies" (*B. T.*, p. 49).

Roche called his theory that "of cometary tides;" he says the electrical "force would not be proportioned to the mass," but "would act with different velocities in different matters," and would explain the multiple tails. He assimilates a comet "to an entirely fluid mass, sensibly homogeneous, but having no movement of rotation;" at a distance the mass is spheroidal, on nearing the sun it becomes ellipsoidal, and lengthens in accordance with the density of the fluid of which its atmosphere is formed.

Huggins made observations (spectral analysis) on Brorsen's comet, and obtained lines which could not be identified with those of any known gas. He afterwards directed his observations to Winnecke's (1868) comet, and at first thought the difference he found was due to his improved appliances. He and Millar, who made the observation with him, agreed the bands coincided with the bands of olefiant gas, and that the lines were due to incandescent carbon (carbon can be volatilized by the lens and the electro-magnetic flame). At the time of the observation the distance from the sun was too great to suppose that the volatilization was directly due to the heat of the sun. If so we must fall back on electro-magnetic properties.

Like everything else regarding comets, the mass and density are subjects of controversy. Newton said, "A globe of air of ordinary density at the earth's surface (sea level), and of its diameter, if reduced to the density due to the altitude above the surface of one radius of the earth, would occupy a space exceeding in radius the orbit of Saturn." The tenuity of the cometary mass and the repulsive power of its particles appear to be conditions of which science is not cognizant. Babinet says the substance of a comet is of no greater density than that of the atmosphere divided by forty-five thousand billions; by this calculation Encke's comet would not weigh more than 1200 tons. Faye says it must have had considerable density, as it appeared as a star of the fourth magnitude. Herschell (J.) speaks of a comet's tail as a mass of a few ounces. Roche, relying on micrometic observations, calculated Donati's comet at 268 billions of tons, and Encke's at the thousandth part of the mass of the earth. Guillemin thinks this mode of computation the safest. Humboldt says, perhaps in no case does the mass of a comet equal $\frac{1}{5000}$th part that of the earth. Of all planetary masses, although their mean density is the slightest, comets occupy the greatest area; in some instances the tail (or cone of reflected light) equals in length the distance of the earth from the sun. The heat to which a comet is subjected at its perihelion is calculated to be twenty-six times greater than is required to melt agate or rock crystal.

A comet has a nucleus, coma, and tail, sometimes several. Whether the nucleus is solid has been much debated; but it appears agreed that its outline is not well defined, and seems to merge into the coma, not by abrupt, but by rapid gradations of light. In Herschell's great telescope two comets only showed a defined disc, those of 1807 and 1811. He supposed their diameters to be respectively 583 and 428 miles. The tails generally appear as elongations of the coma. That of 1874 had six tails spread out like a fan. That of 1807 two, both turned towards the sun; of 1827 two, one of which was almost directly turned towards the sun. Some comets have been of surpassing brilliancy, equalling that of the sun, and seen in daylight. That of 1500 was observed for ten days and nights. That in 1577 is recorded by Tycho Brahé. That of 1743 (Chauveau) was brighter than Sirius, and visible in the presence of the sun, and also those of 1402, 1523, 1577, 1744, and 1843.

When first seen they appear as whitish clouds, the side towards the sun appearing brighter; the light for a short distance seems to turn towards the sun, and then streams out in an opposite direction. The brilliancy of the head is supposed to be produced by a diminution of the nebulosity surrounding the nucleus and the condensation of its atmosphere. They have been observed of a ruddy hue, of a leaden whiteness, with a reddish coloured nucleus, and a nebulosity of bluish green, of a golden-yellow light, of pale white and of glistening flame, various forms are assumed by them, some have several nuclei.

Humboldt and Arago observed in Halley's comet (1835) that the rays were of different colours on different nights. Comets vary as to their periods, some are of short, others of long intervals. The period of that of 1680 is calculated to have been 88,000 years. That of 1811, 3065. Some visit our system and never return. That of 1264 reappeared in 1556, but never returned. Liäis's comet made several appearances at varying intervals, the perturbations of its course were supposed to be occasioned by Jupiter, its visits have ceased. It is not supposed that all the comets visiting us belong to the solar system; whether they form groups, or systems, or whether their original orbits are converted into closed orbits by planetary influences, or what the true facts are concerning them is not determined. The periodical returns are calculated by the geometric curves.

Encke conceived the interplanetary spaces to be filled "with a medium of sufficient density to oppose to the movements of planetary bodies, . . . a resistance capable of producing in the course of time modifications in their orbits." The long ellipse of a comet is continually "retracting," and at length becomes spheroidal, and "thus might revolve around another body; but it is doubtful if it would ever be precipitated into it." The comet of 1680 when in perihelion was only $\frac{1}{6}$ of the sun's diameter from his surface, the elasticity of the ether and polarizing effects thrusting it away. Liäis believed that all cometic phenomena were due to the elasticity of the ether. Schiaparelli connects the August and November meteors with them, and particularly instances Tempel's and Biela's comets.

Faye, reviewing all the cometary theories, concludes, "there is an actual repulsive force in the sun's rays," and that "the action is proportioned to the surface of the body acted on and not to its mass." He assumes "its intensity decreases inversely as to the square of the distance, and that its velocity of propagation is that of a ray of light." In conclusion, he says "the figure of a comet and the more extended portions of the tail are purely the results of the mechanical action of the two forces, the Newtonian attraction and repulsion of heat;" Crookes' experiments on light appear to have relation to this subject. If the mass (a heavy metallic mass) is colder than the ball, it repels, if hotter it attracts it; the reverse occurs when the ball is *in vacuo*. Reichenbach's theory of odyllic emanations may elucidate the fact that the action is proportioned to the surface. The emanations appearing on the surfaces of magnets and other substances "are purely magnetic or auroral phenomena."

People in the present age have been alarmed by the idea of the earth's contact with a comet[1]. Whiston said the comet of 1680

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[1] In early ages when they appeared they were regarded as prognosticators of diffi-

(Halley's) "4000 years before" had caused the Deluge, and that eventually it will set fire to the world. Maupertuis (1742) wrote, "Some comets passing near the earth might so alter its movements as to cause it to become a comet 'eternally frozen and roasted in extremes.'" He supposed a comet might sweep away the moon, and then as an alternative suggests it might be compelled to rotate around the earth and afford the light of a second moon. Pingré, quoting him, says, "Who knows but in former times we thus obtained our moon? the more probable as being based on a tradition of the Accadians, who believed themselves, Lucian and Ovid say, to be more ancient than the moon." De Séjour disproved the hypothesis of Maupertuis.

It is calculated that if Biela's comet did not come in contact with the earth it must have grazed its surface; it is not doubted that in 1861 the earth passed through the comet's tail. It is also probable those of 1819 and 1823 mixed with the earth's atmosphere. The question of a comet's contact with the earth, it has been said, presents an easy problem; Hind, Valz, Lowey, and Le Verrier say the calculations are most complicated; Arago calculated the odds of a collision, and pronounced it to be 281,000,000 to 1, and of a contact with the entire nebulosity the odds would be ten-fold greater. La Place said, "Comets pass with such inconceivable velocity that the effects of their attraction need occasion no alarm;" but he appears to have considered that some such collision had taken place, the evidence being the relics on the mountains. (Fossil remains owing to the elevation of seas' bottoms.) Laland says if a comet approached within 4000 miles of the earth it would raise the sea 2000 fathoms above its ordinary level.

That comets sever we know, as Biela's. There are traditions of similar events. Ephoras, according to Seneca, had the record of

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culties and miseries. That of 1456 (Halley's) was considered to be the harbinger of the vengeance of God, the dispenser of the most dreadful of His retributions, war, pestilence, and famine. By the order of the Pop all the bells in Europe were rung to scare it away, and the faithful were commanded to add each day another prayer (*Draper's Conflict*). Draper says: "So tremendous was the apparition that it was necessary for the Pope himself to interfere. He exorcised and expelled it from the skies. It slunk away into the abysses of space, terror-stricken at the maledictions of Calixtus III, and did not venture back for 75 years." "On this occasion it was declared that a victory over the comet had been vouchsafed to the Pope." There is another legend attached to it. At the time of its appearance the Christians were at war with the Saracens. The Pope in order to give encouragement to the Christian hosts, assumed that the comet was in the form of a cross. The Sultan Mohammed assumed it had the form of a Yataghan, and was a blessing of the Prophet. The Pope, ascertaining it had that form, excommunicated it. Notwithstanding the rival superstitions, the Christians were victorious under the walls of Belgrade, an event the Christian world supposed to be entirely due to the Pope's curses.

a comet divided in two. Kepler considered that the comets of 1618 formed originally but one comet; Cytalus says the greater of the two showed a tendency to shiver into fragments. When first seen it was as an orbicular nebula; it then appeared as several distinct, cloud-like masses, and then as a multitude of small stars. Liäis says the Olinda (1680) was a double comet. According to Biot, the Chinese have a record of three comets joined into one; Pingré, quoting Nangis, says that of 1348 separated into several fragments. It is said that the whole firmament is strewn with wrecks of comets, Kepler stated they were numerous as fishes in the sea.

Biela's divided comet is a fact of our time; we had the floating mist with nucleus, coma and tail so incohesive that the stars shone through its substance; again and again it floated in its place in the heavens; again it came, but the presentment was two kosmic bodies. It had divided; in the sky was the floating fact; they did not re-appear, but in the place of the comets were showers of flaming meteors occurring in the exact point in the heavens which the comets should have occupied.

Meteors, meteorites, and rings of stones are all supposed in some way to be connected with comets "floating in the waves of the ethereal ocean;" remains, as some philosophers affirm, of kosmic incandescence or nebulous matter unused in the formation of suns or systems of suns. The wrecks of comets are multitudinous, and in that vast period of time which has elapsed since the universe was framed, interplanetary space has been furrowed with the fragments of their structures, and these the planets in their revolutions cannot fail to encounter. These fragments Schiaparelli connects with shooting stars, which are so numerous that they must be considered not as isolated masses, but as swarms or systems of meteors. Their point of convergence is called the radial point. Their periodicity is not alone annual, for there are systems of meteors occurring in periods of 33½ years, coming from depths in space far beyond the range of the outermost planet of our system. Schiaparelli assumes—although the nebulous mass was globular at first, yet it will be transformed in the vicinity of the sun into a parabola, and of less than its original density, requiring hundreds or thousands of years to effect its perihelion passage. He calculated that the August flight of meteors corresponded to the parabolic motions of comets, and that the November display was identical with the ellipsis of Tempel's comet of 1861. He also supposed the meteors were identical with the courses of other comets, and has prepared a table of them (*vide Guillemin's Comets*). He does not say these kosmical streams are identical with broken-up comets, but that they occur in the paths of comets. The inference appears to be that comets are rings of meteors. If so, why are they not always visible? or are we to assume they become visible and put on the aspect of a comet only when the earth in its orbital range approaches them? We in such a case must conceive that ring interlaces ring within the earth's orbit. Proctor connects Biela's comet with the meteor displays. Humboldt (*Cosmos*) gives grand descriptions of the periodic display of these meteor flights. In Cumana in 1789 and in North America 1833-4 there were streams of meteors and balls of fire not only contemporaneous and intermingled, but they gradually appeared to pass one into the other; the magnitude of their discs sometimes exceeding in size the apparent diameter of the moon, the trains which accompanied them, the velocities of their movements, exploding, and smoke emitting balls of fire, even luminous in the bright sunshine of a tropical day, gave an impression of wonder and awe. There were also shooting stars less in number and of varying dimensions; sometimes exhibiting only as moving points of light, at others as phosphorescent lines (Humboldt's *Cosmos*).

In ancient authors there are many records of a fiery rain. Poissin has imagined the ignition of aerolites occurs far beyond the range of our atmosphere. The height at which they become visible, and when their visibility ceases, he supposed to range between sixteen and one hundred and forty miles. Those which occurred in 1839 are supposed to have come from a point in the heavens between Perseus and Taurus, and those of November, 1833, from γ Leonis. The independence they exhibit of the earth's rotation shows they have "entered our atmosphere from the external regions of space." It is in analogy with our "views of the formation of the solar system to admit the existence of small planetary masses circulating independently in space."

The aerolites fall in various places on the earth as malleable masses of iron, but differing in quantity, some containing $\frac{96}{100}$, others only $\frac{2}{100}$. Some contain more hydrogen than by mechanical means can be forced into the substance of malleable iron, *e.g.* the meteoric iron of Lenato; which fact is seized on to support the hypothesis that they have been ejected from an atmosphere of flaming hydrogen. Although for many hundreds and thousands of years there have been falls of meteoric masses—it is said seven hundred in a year of reputable size fall—yet none have been found in the earlier geological strata. In past ages they were treasured as objects of worship and as gifts of the gods; Caliphs have had swords forged from freshly fallen meteorites;

whole districts have been paralyzed by their devastations and alarmed by their detonations, and men have been killed by their fall, yet until the time of Chladni this great cosmic phenomenon was unheeded by science.

Cassini was the first who investigated the phenomena of the zodiacal light (1688). Leslie (*Polar Seas and Regions*) has an interesting description of the aurora (p. 240), and gives a glowing description of the phenomena. He says, "No rule, however, could be traced in the movement of those lighter parcels called the merry dancers which flew almost perpetually to every quarter; becoming in stormy weather more rapid in their motions and sharing all the wildness of the blast. They gave an indescribable air of magic to the whole scene, and made it not wonderful that by the untaught Indian they should be viewed as the spirits of his fathers roaming through the land of souls."

Captain Lyons said it was difficult to conceive that the sudden glare and rapid bursts of these wondrous showers of fire were unaccompanied by sound, and that he had stood for hours on the ice listening, and was convinced no sound came from the aurora. Parry said he could not expose his ears sufficiently long to the cold to be satisfied on the point. It was decided also that the aurora dimmed the lustre of the stars, as though a thin gauze had been drawn over them. Each person sees his own aurora; to Parry it assumed the tints of yellow and lilac; to Lyons the colour of the milky way or of very vivid sheet lightning. Leslie says his impressions agree with those of Lyons. Humboldt (*Cosmos*)[1] says he has seen "it shine with greater brightness than that of the milky way near the constellation of Sagittarius" not only on the "summits of the Andes," but on the "llanos of Venezuela" and on the coasts of Cumana, "white bright and varied tints" like "a second sunset," and almost equal to "the light of the moon in her first quarter." Humboldt says the phenomena "are not the luminous atmosphere of the sun,"[1] but that their existence may be attributed "to an extremely oblate ring of nebulous matter revolving freely between the orbits of Venus and Mars;" an assumption, he says, favoured "by the observations of Olbers" of "the sudden flashings and pulsations of a comet's tail." He also says in a few instances he perceived "not indeed a red colour or a dark arch beneath, or, as Marian describes, a jet of sparks," but as though it were an undulatory motion of light.[2]

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[1] Humboldt (*Cosmos Sabines Trans.*, p. 180) appears to have collected and collated with his own experience all that science, in his time, knew of the aurora. "Low down in the horizon, about the part where it is intersected by the magnetic meridian, the sky, which was previously clear, is darkened by an appearance resembling a dense bank or haze;" "the colour of the dark segment passes into brown or violet, and the stars are visible through it as in a part of the sky obscured by a thick smoke." "A broad luminous arch, first white and then yellow, bounds the dark segment." But as the arch does not appear until after the segment, Argelander says it cannot be attributed to mere contrast. "The highest part of the luminous arch is not quite in the magnetic meridian, and where the horizontal magnetic force is weakest the middle of the arch differs more widely from the magnetic meridian." The more intense the discharge of the aurora, the more vivid the display of colours, from violet and bluish white, through all gradations, to green and crimson. In common electricity, excited by friction, it is found the spark becomes coloured only when a violent explosion follows high tension. At one moment the magnetic streamers rise singly, and are even interspersed with dark rays resembling long dense

Davy endeavoured to show that the aurora was caused by a discharge of electricity at the upper limits of the atmosphere, its appearance always producing a disturbing effect on the needle. In the tropics the hour of the day "may be known by the direction of the needle," "it is affected instantly, although transitorily, by the distant aurora." "Telluric magnetism and electro-dynamic forces, measured by the ingenious Ampère, were found to be intimately connected both with the terrestrial or polar light (aurora) and with the external and internal temperature of the earth." Halley conjectured the aurora to be a magnetic phenomenon. "By Faraday's discovery of the evolution of light by the action of magnetic forces Halley's conception is made a certainty." "The fact that gives the phenomenon the greatest importance is that the earth is self luminous; that besides the

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lines of smoke, at another they shoot upwards from many opposite points of the horizon and unite in a quivering sea of flame, . . . every instant its bright rays assume new forms. "The last trace that remains of the whole spectacle is often merely a white delicate coloured, feathered at the edges, or broken up into small round masses like cirro cumuli clouds" (*Cosmos*). Thieneman, Franklin, Richardson, and Wrangel remark: "The aurora shoots forth the most vivid rays, when masses of cirro strati are hovering" above. The connection of the Polar light with cirrous clouds shows the electro-magnetic evolution of light as a part of the meteorological process. The results of the measurements of the heights of the aurora vary from a few thousand feet to several miles (Farquharson). It may be driven to and fro by the winds and currents of air. Humboldt says: "Manifold, no doubt, are the sources of terrestrial light; we may even imagine it to exist as latent."

[1] The luminosity of the sun is so great that the Drummond lime light appears as of an inky black when projected on the sun's disc.

[2] In the Austrian Arctic voyage, 1872-4, Lieutenant Payer says: "The magnetic disturbances were of extraordinary magnitude, and frequently they were closely connected with the aurora, and were greater as the motions of the rays were more rapid and fitful and the prismatic colours were more intense. Quiescent and regular arches, without changing rays or streamers, exercise almost no influence on the needle (v. i, 338). Although electrical processes still unknown seem to be the main cause of the aurora, atmospheric vapours may, however, have a considerable part in producing the phenomena" (*ib.*, 324). Lieutenant Weyprecht, after describing the play of the aurora, says: "The band has nearly reached it, and now begins a brilliant play of rays lasting for a short time, the central point of which is the magnetic pole, a sign of the intimate connection of the whole phenomena with the magnetic forces of the earth; round the magnetic pole short rays flash and flare on all sides, prismatic colours are discernable on all their edges, longer and shorter rays alternate with each other, waves of light roll round it as a centre" (*ib.*, 331).

light which, as a planet, it receives from the central body, it shows the capacity of sustaining a luminous process proper to itself."

Science affirms the earth is a magnet; if so, it has poles which can attract and repel. Man is a magnet; two persons insulated, brushed with a skin, on approaching their clenched hands will produce a spark.[1] The magnetic force of the earth is manifested on its surface in three modes, viz. by the varying intensity of the force, by its varying direction, as shown by the inclination of the magnetic needle in the vertical plane, and in the declination from the geographical meridian; its effects are represented in the lines—Isodynamic, Isoclinal, Isogonic, or equal force, equal dip of inclination, and equal variation or declination. Oersted, Arago, and Faraday established the intimate relations between the electrical tension of the atmosphere and the magnetic charge of the earth. At a white heat magnetism disappears, but it is still sensible in iron heated to a dark red glow; its varied phenomena "lead to a belief in the existence of various and complicated systems of electric currents in the crusts of the earth." Humboldt inquires, has the rotation of the earth and the velocity of its different zones, according to their distance from the equator, any influence on the distribution of magnetism? And whether the source of magnetic action was to be sought in the atmosphere, or in the interplanetary spaces, or in the polarity of the sun and the moon? Galileo, in his *Dialogo*, ascribes the constant parallel direction of the earth's axis to a centre of magnetic attraction existing in space. Humboldt thought in the then state of our knowledge no satisfactory reply could be given to questions respecting the ultimate physical causes of phenomena so complicated.[2] The question of the source of the earth's magnetism, so far as relates to its physics, appears to be solved by Reichenbach's analysis of meteorites. He shows that if a piece of magnetic iron be broken up, however small the fragments may be, there still exist the polar facts.

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[1] In a cold winter, 1855, New York, I saw a lady, clothed in black silk, run several times across a carpetted room, she suddenly drew her hand down her dress, applied her finger to the gas burner, and the jet, turned on for the purpose, was ignited. That this phenomenon should excite a remark in the *Times* shows the insufficiency of the general knowledge of electrical results.

[2] The hydrographer to the Admiralty (March 11, 1878), before the Geographical Society, discussed the question of the Earth's magnetism. After giving an historical sketch of the subject since the discovery of the dip of the needle, said since the time of Gilbert various additions have been made to our knowledge, but we are ignorant of the causes of the great changes observed, and which probably have continued through æons of time. Halley observed that the convergence of the needle led to two points in each hemisphere, and concluded "that the whole globe is one great magnet having four magnetical poles," to account for which and for the secular change of the variation, he conceived the earth might be a shell containing within a solid globe or terrella, which rotated independently of the external shell, each having its own magnetism passing through the common centre, but that they inclined to each other and to that of the earth's diurnal rotation. Hansteen a century after (1811-1819), came to the same conclusion as to the four poles of attraction; acknowledging Halley as the first who had discovered the true magnetic

Reichenbach maintains that there is no distinction between a planet and a meteorite, excepting in size, and this now appears to be the conclusion of science. Newton had before said "He took all

attraction of the globe, he went further and computed both the geographical positions and the probable periods of the revolutions of this dual system of poles. He found the North American pole required 1740 years to complete its grand circle around the terrestrial pole, the Siberian 800 years, that on the Antarctic regions of South Australia 4609 years, and the secondary pole near Cape Horn 1304 years. Sabine (1864-72) in part followed Halley's views, and considered the two magnetic systems to be directly recognisable in the magnetic phenomena of the globe, the one terrestrial, the other kosmical. The point of the greatest attraction in the Northern Hemisphere is stronger; the weaker system (kosmical) has at present its greatest point of attraction in the north of the Asiatic continent, and that the kosmical system by progressive translation gives rise to the phenomena of secular change and to the magnetical cycles which owe their operations to that cause. Reviewing these hypotheses by recent observations, it is impossible to recognise their accordance with the changes which are now going on, yet at the same time not to recognise that Halley's and Hansteen's deductions were borne out by those facts. Between 1700 and 1819, in the Northern Hemisphere, in the higher latitudes there was a general movement of the north end of the needle over the area from Hudson's Bay to the North Cape of Europe, and from Cape Horn to the northern part of Australia, the north end of the needle was successively drawn to the west at a *maximum* rate of 8′ or 10′ a year. From the meridian of the North Cape of Europe to that of 130° E. it was successively drawn to the east, whilst from thence to Hudson's Bay it was nearly stationary. In the Southern Hemisphere, from the western part of Australia to Cape Horn the movement was throughout to the east at a maximum of 7′. Thus there was a general uniformity of movement dividing the globe into Eastern and Western Hemispheres—the needle was constantly drawn more and more to the west on that part embracing the Pacific, more and more to the east in the other portion. In the early part of the century there was a harmonious movement of the needle over the whole earth. In 1818 at London, and contemporaneously throughout Europe and North Africa, the westerly progress of the north end of the needle ceased and an easterly movement commenced, and continues at a yearly increasing rate; but in the South Atlantic it has never ceased. Sabine's views imply that the poles of attraction having a terrestrial course, *i.e.* the magnetic poles, are not subject to translation. When further followed, the hypothesis is beset with difficulty, as it can scarcely be conceived that changes due to kosmical action can be other than general in character, and must affect the whole globe; we should anticipate uniformity in the general movements of the needle, but modern experience disproves it. In some regions there is great activity of movement, in others, comparative repose, this leads to the conclusion that certain movements are going on in the interior of the earth, and that the secular changes are due to those movements, leading to Halley's conception of an internal nucleus, itself a magnet rotating within the outer magnetical shell of the earth. Captain Evans calls this "a fanciful conception;" but still it is necessary to examine the behaviour of the intensity of the earth's magnetism to see how far it corroborates this view of the interior movement. He then commented on later results, and concludes—whichever way we look at the earth's magnetism and its changes we find marvellous complexity aud mystery. Time and increased knowledge appear to have thrown us further from the solution, for the terrella of Halley, the revolving poles of Hansteen, and the more recent hypotheses of the ablest men of the day fail to solve the mystery.

the planets to be composed of the same matter, viz. earth, water, and stones, but variously concocted" (*Conversations*). Rose has shown "that aerolites which possess a fine grained texture have a telluric appearance, and contain Olivine, Augite and Labradorite, as that of Juvenas" (*l'Ardèche*). "They contain, in fact, crystalline substances, quite similar to those of the crusts of the earth, and in the meteoric iron (Siberian), the olivine is only distinguished by the absence of nickel, replaced by tin."[1] In Senegal meteors are said to form hills of iron. Those of Bahia, Durango, Zacatecus, are of many tons weight. Those of Aix-la-Chapelle but of a few tons. Ordinarily, meteorites are but a few pounds weight or less, and probably constitute the phosphorescent rain spoken of by Humboldt. The structure of the meteorite gives the key to the internal condition of the earth (the spectrum appears to prove that planets and meteorites are of the same composition), they consist, for the most part, of metallic masses, generally of iron, with nickel, cobalt, and stony substances. The iron presents a network of cells, pervading the mass; in those of Krasnojarsk, Atacama, and Bittburg, they can be seen by the unaided eye; those of Smolensk, Seres, Blansko, Taber, &c., have the same structure, but are more minutely mixed; when the stony part is removed the cell structure is apparent; they vary in their specific gravity as 3, 4, 5, that of the earth being 4·7. The earth's interior is probably a network, "a coherent mass of iron cells," and "in this iron the magnetism of the earth resides." Inequality in the distribution of the constituents is seen in every meteorite, and it is a fair presumption that a similar arrangement would be found in the structure of the globe; the facts thus far are matters of observation, and appear to be confirmed by the number of iron lines found in the solar and other star spectra.

The meteorite of Clairbona (Alabama) was encrusted with slag $\frac{1}{5}$th and $\frac{1}{3}$rd of an inch; that of Caryfort (N. America) $\frac{1}{6}$th; of Nanjemoy (Maryland), $\frac{1}{7}$th; from such a covering to complete igneous fusion there is a wide difference. Beneath the lowest geological formation "the earth has certainly a red hot or still fluid covering several leagues thick, analogous to the coating of slag on the meteorite, but we cannot conclude, as is hastily assumed, that there is a state of fusion thoughout its whole mass (*Reichenbach*). Faraday inferred that if the earth was an igneous fluid throughout, it could not be magnetic, because such a "temperature would be irreconcileable with the presence of magnetism." Thomson has an hypothesis that although intense heat exists in the interior of the earth it is not in a fluid state, owing to the immense pressure;[1] if so, it is induced by its superincumbent masses, and not by an incandescence;[2] the latent heat would become active by the pressure. The heat of the interior of the earth is relieved by volcanic action.[3] It would appear that the Japanese paid great attention to volcanic phenomena, and probably two thousand years ago they had some geological system, or they could not have invented an instrument which measured not alone the volcanic vibrations, but which also showed the directions in which they occured.[4]

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[1] A meteoric stone found in California appears to differ from all meteoric stones before found; it is said to be streaked with gold, and so hard that it is impenetrable to force and irreducible by acids, presenting an amalgam which, if it could be imitated by art, would be perfect.

"All meteorites are molten on their surface (due to an external heat); internally, they are *crystalline formations* proceeding from a force which can be shown to have operated entirely at a lower temperature." A crust of glowing fused matter, "even if it were of several miles in thickness, would be insufficient to destroy or materially to diminish the effects of the magnetism of a vast iron-pervaded cold sphere of 8000 miles and upwards in diameter" (*Reichenbach*, *et vide supra*, p. 219).

Reichenbach says "meteoric stones when cut, polished, and slowly etched by dilute nitric acid, crystalline spheres appear in every portion of the iron, however small, they may be distinctly recognised under the microscope," presenting "the same appearance on masses of meteoric iron as those called the figures of Widmannstetten, and are nothing else than crystalline forms magnetically constituted;" he continues, "I have examined many meteorites, and have uniformly found the reguline iron crystallized exactly in the same way as in large masses of meteoric iron," and "picked out of the Blansko meteorite small portions of iron, which, when polished and etched, notwithstanding their small size, exhibited not only planes of cleavage, but crystallized pyrites enclosed in the iron, undistinguishable from those in large masses; thus they include a twofold source of magnetic and odyllic polarity; *they consist in part of cellular, but yet coherent masses of iron*, and *these metallic masses are crystallized*, and perhaps form in each case a single large crystal, externally indeed irregular, but internally cohering according to the laws of crystallization." "The presence of iron and the crystalline form act together in producing magnetico-odyllic poles in the earth, which are to be ascribed, not only to external causes, such as solar rays, but in a great, and perhaps for the most part, to internal causes." "This," he concludes to be the reason "why the astronomical and magnetic poles do not coincide; the earth having not only two, but four magnetic poles, and many others," therefore, "the earth may be supposed to draw its polar light from internal sources" (*Research. in Mag.*).

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[1] The Astronomer Royal (Cumberland), speaking of the pressure on the earth's centre, says—Rocks press more closely on each other as the centre of the earth is approached; to crush Aberdeen granite would require a pressure of 10,000 lbs. to the square inch, but the pressure on the earth's centre must amount to 30,000,000 lbs. Such a pressure is inconceivable; perhaps thereby gas is squeezed into platinum or gold, powder into solids and solids into powder, and he infers from the action of the plumb line in respect to the Himalaya mountains, that the whole country (Hindustan) is floating on a dense fluid; the displacement of the denser matter by the mountains sinking into the fluid, neutralizing their attraction.

[2] Morris says the temperature obtained from rock borings only indicates that of the water contained in the orifice, which cannot be assumed to be that of the rock, for this temperature is probably due to the air or to the water decomposing, and that the temperature at great depths cannot be arrived at by the water or air so obtained. A thermometer hung in a mine registers the temperature of the ventilation in that place, and is useful only as qualifying barometric readings. He suggests a mode by which a true reading may be obtained.

[3] Reyer repudiates the idea of basing the classification of igneous rocks alone on their geological age, and insists that portions of the same magma, under different conditions, will assume a granitic, a porphoritic or vitreous structure, as igneous intrusions are found associated with sedimentary deposits probably connected with volcanic activity; and he more than infers that granitic structures are formed in the present era by consolidations under the pressure of portions of the magma below volcanic vents.

[4] Seventeen hundred and fifty years ago Choko, a Japanese, invented a seismograph, by which an earthquake occurring at a distance could be recorded. The implement is a cylinder eight feet in height, with rods and springs so systematically arranged that on an earthquake occurring a ball lightly poised in a dragon's mouth fell into that of a frog's beneath, indicating the direction whence the shock would proceed. There are eight dragons with their attendant frogs.

In parenthesis, I would say, it appears to be conceded that the earth is a magnet. If one orb be a magnet, by a parity of reasoning it must be conceded that all the orbs which throng in space are magnets, and that the Universe is one vast magnet conditionally regulated, probably intermittently (a property found so necessary in late electrical discovery), the systems of suns representing broken circuits with a continuity of conduction. All planets have the same relations to their central suns as those suns have to the universal system. The effect of a broken circuit with continuity of conduction is seen in the action of the microphone. In this broken circuit, in *minimum* do we see the representative fact of the Kosmos? The familiar idea of *direct solar heat* may, after all, be but an illusion of sensation. If the hypothesis of the correlation of forces in its principle be confirmed, it were easy to conceive the transmutation of any of the forces, and that which *we know as direct solar heat may be due to a correlate action;* the rule of the inverse square precluding the idea of *direct* solar heat.

The knowledge of the laws of nature, whether revealing themselves in terrestrial phenomena or in celestial mechanics, renders us conscious not only of the strifes but of the calms of nature, seeming disorders being but the processes of changes where catastrophisms become initiatory fulminations inducing order. The Universe at the same time our admiration and our mystery, is a mystery only to that finite appreciation which assumes to itself the capability of resolving the infinite. When we look on Nature, in our endeavour to unriddle the Kosmic appliances therein disclosed, we find a Universe of Effects—effects which have arisen from a vast stream of intellectual impulsions, of so admirable an institution that effects and their cause—intimately blended and perfect in construction—appear to be governed by an innate development; whereby asperities are softened, weaknesses strengthened, advances by infinitesimal gradations fashioned, decays recuperated, powers intimately impressed and the immense variations and changes so homogeneously interfused, that as the attributes of Nature we perceive but successions interminably prolonged; but when we conceive Nature as a thought transfused into effects, we then conceive the Universe as a Creation manifested for a purpose, and its design must have been originated by an intelligence, with power sufficing to unfold all phenomena in its embrace. As it is impossible to gaze upon a machine without contemplating at the same time the intellect by which it was designed, then, as it is impossible to disunite the mind of the constructor from the machine which resulted from it, so also it is impossible to dissociate from the scheme of Creation the idea of the Intellect or *God* by which the Universe was called into being. Bell was of opinion that "the external world only exists for us as we receive it within ourselves, and as it shapes itself within us into the form of a contemplation of nature." Of this opinion also was Humboldt, who adds, "As intelligence, language, thought, and signs of thought are united by secret and indissoluble links, so in like manner, and almost without our being conscious of it, the external world and our ideas and feelings melt into each other;" or, as Hegel expresses it, "in our internal representations of them."

When Reichenbach promulgated his theory of odyllism (magnetic emanations), principally known in England through Gregory's translation, it was met by the cry of charlatanry, and the echo of the imputation still exists. Passingly I would say such a mode of suppressing theories is convenient, because thereby examination and experiment are avoided; and more, as an utter ignorance of the subject becomes veiled by the assumption of knowledge and learning. Nevertheless, it is my belief that these odyllic emanations have the same basis as the sun and star spectra—the reflections of the spectrum on the screen being but the radiance of the substances incorporated in a ray of light. Reichenbach's patients represented that metals were accompanied by coloured emanations[1]—now this is exactly what the spectroscopist claims. There are occult forces underlying vital and objective phenomena; is it because the springs of their energies remain mysteries that they should be, as many other scientific suggestions are, smothered by clouds of learned ignorance?

More than twenty years ago a *spirit medium* was taught at a *séance* that an impression on the retina of the eye is fixed there until erased by another impression, and that the last impression received in life remained impressed in the dead eye, and that thereby a murderer might be detected because his image would be the final one; this of course was but the maniacal dreaming of a spiritual medium, and the *informed* scientific pooh-poohed the whole affair; yet Kühne, by a series of experiments on rabbits, &c., has demonstrated the fact (*vide Kühne*, *Visual Purple*, p. 63-74, *et infra*).

All acquainted with scientific details know the treatment that an eminent physicist received from "men of science," as though they did not lend themselves to wilder theories than the odyllic and spiritual involve. No doubt all the comments upon such subjects are the result of *involuntary cerebration* and *the materiality of the intellect inbred by the substance of the brain.* The fairness with which such subjects are treated may be seen in the article "Science and the Spirits" (*Frag. Sci.*), and in that on the "Radiometer" (*XIX Cent.*, vol. i, p. 256). When the conjurations of Maskelyne and Cooke are produced as evidences in disproof of an occult something which hitherto has been unexplained, it can create no surprise that the commentator should reject the verification of the senses or deny the conclusions of common sense.[2] If the arguments adduced by Dr. Carpenter in his work (*Mesmerism and Spiritualism*) and elsewhere are carried to their logical extreme they would be subversive of all theological formularies and directly contradict Paley's grand summary on the weight of evidence. The question is not one of technics only, it involves realities of the gravest character. All theological explanations are based on the so-called miraculous and on revelation. Is not the whole of Theology based on statements which would be "*completely in opposition to the universal experience of mankind as embodied in those laws of nature which are*

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[1] *Vide* pp. 158-9 (*Research. in Mag.*), where he gives a table of the colours of the magnetic emanations

[2] "I would not for a moment uphold that test (common sense) as an infallible one, but it ought to be sufficiently regarded to make us question the conclusions which depend solely upon our own or others subjectivity" (*XIX Cent.*, art. "Radiometer," April, 1877). By what other means are evidential tests to be established?

accepted by all men of ordinary intelligence?" Carpenter italicises the sentence. If there be anything in this emphasized opinion, it cuts away the root not only of all psychical experiences, but the very fundamental principles of all theologies. Is that what he means? in other words, it is the general scientific assumption that the unknown must be interpreted by the known, which in reality is a denial of that underlying current, innate and present with all men, which all men experience, although many choose to deny it because not chiming in with that which is called *scientific discovery.* Let such reasoning be affirmed, and the no God hypothesis will exist in its vigour. The elevation of man is due to a conception of the ideal, an inborn principle eliminated by culture; in a word, the "religious sentiment," which assumes its prominence as the bond link knitting the human and the divine, distinctly marking the affinities which exist between man's *alter ego, i.e.*, his entity, spirit, soul, or essence, and that inexpressible intelligence in which all things exist and out of which all things have flowed. This no God, or no Spiritual principle may to some minds be a conclusive argument; it is perfectly clear that if there be no spiritual affinities existing within the interior conception of man, the no God and no Spiritual hypothesis is the true interpretation of man's position—and then Nature and man's intelligence are *but the result of a chance or accident infinitely repeated*, a jumble of rubbishing absurdities, which no man who has a possible claim to a knowledge of psychological or anatomical or physiological science could by any possibility accept; yet a grave professor, who assumes to have all these scientific positions at his tongue's end, stands up before an audience of thinking men and asserts this position.

Upon the spiritual theory in its so-called *manifestation* phase I pass no opinion.[1] To me "*spirit mediums*" appear to be no worse than the theological tricksters who have endeavoured to fetter thought by an assumption of the miraculous—priestly impostors who have presented clever mechanical arrangements as divine interpositions. An attack on an hypothesis, even if it be the barest assumption, at least should be based on a knowledge of the fundamental principles upon which the hypothesis is built; and however high may be the scientific attainments of those who lead the assault, something more should be adduced in contravention, than hypothetical assumptions of scientific impossibility, and more than negative evidence is needed when men of high scientific rank positively affirm a truth and produce evidences in support of their affirmations. There may be as much unreality in the incredulity of the opposers as there may be in the upholders of the spiritual theory, and quite as much charlatanry in the assumptive denial as there is with the *public mediums* who assume to possess extra mundane powers. The spiritual theory in its real spiritual significance, and it may be said, religion also, are wholly removed from scientific definition and appear in no way to be amenable to *scientific* law. If in the world there be nothing but what is capable of scientific proof, miserable indeed, were the lot of man—an oyster revels in a paradise unattainable by him. A man before he is in a position to decide spiritual possibilities should at least be affiliated in *interior presumptions;* this the author of *Mesmerism and Spiritualism* does not appear to be. Before men go out of their science and pledge themselves in support of an adverse proposition, it were well that they reflected upon the lesson taught by the rabbits of Kühne. Kühne's disclaimer (p. 68, *Visual Purple*) of this connection does not make the medium's announcement the less curious, not to say the less important, to those who produce physical testimonies in support of *spiritual* experiences. If the spiritual hypothesis is to receive a root and branch condemnation many a healthy faith would be involved in the ruin. In this war of ideas the possibility should not be forgotten that there may be as great Kosmic mysteries concealed beneath the *occult* (the companion of man in all ages of his history) as there are in many so-called mystical presentments of nature. There is no charlatanry in the proof which Reichenbach has deduced as to the magnetic properties of the earth from the construction of meteorites nor in his chemical discoveries. Accident led him to the knowledge that by some persons, emanations in the shape of "lambent" flames, were seen to issue from the poles of a magnet. His observations on the phenomenon were first conducted through patients suffering from hysteria; eventually he found the same faculty in persons in all ranks of life and in all states of health, and thereby arrived at the conclusion that the flames from the magnet can be seen by one third of the human race; by a lesser portion those from crystals, and by a still less number those from other substances. He was convinced that there is a peculiar principle inherent in magnets and crystals and more or less prominently presented in metals and wood; this principle or force he found to be allied to heat, magnetism, and electricity—of the nature of each of them, but differing from them in generally observed facts. The force he called *Odyll.*[1] Science calls this *charlatanry*, therefore persons are deterred from investigating the phenomena because science has tabooed it. I once saw the emanations; the experience was not only unsought, but I was unaware that there was such a possibility. In 1855-6, being in New York (U.S.), I called on a friend, and was shown into his library. After being there a short time my attention was excited by what appeared to be a white oscillating flame on his book table. Struck with the singularity of the appearance, I went up to it, to ascertain the cause, and saw set upright a large magnet without the armature, from the poles of which the light appeared to proceed. In the midst of my wonder my friend joined me, and I directed his attention to the magnet. He said he saw nothing. On describing what I saw he said it was the Odyllic light which he had much desired to see, but had not seen, nor did he then see it. Another friend (in England), an M.D., had read of the Odyllic light, and determined, if possible, to see it. He procured some powerful magnets and set them up in his study. He had invited a friend to share his vigil, who broke the appointment. In the silence of the night he entered his study where the magnets had long been flaming, but saw nothing. Hour after hour passed, and there were no magnetic flames visible. Suddenly there glanced about the room beads, chains, and streaks of light most brilliant in character. He was startled by the appearances, so different from what he expected, he lost nerve, and precipitately bolted from the room and locked the door, in the veritable belief that all was of "the devil's doing." He regretted his precipitancy on finding that the display he witnessed is rarely seen, it is said, only by the most sensitive individuals. The explanation to be given is that the atmosphere had become luminous through the magnetic emanations, which by his long stay in the room had entered his system. I believe he never again repeated the experiment. Lights such as those my friend the M.D. described possibly could be photographed, certainly that seen by me, for the light I saw was visible in the noonday sun in May, in New York.

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[1] Those who go to public séances to witness spiritual wonders are as much to blame as they who assume to have the power to exhibit them. Were there no dupes, there were no charlatans. There can be but little doubt the persons setting up such pretensions had witnessed something unusual occurring through themselves; and, however disgusting the cupidity which induced the exhibition of a power which they supposed they could direct at will, in excuse it may be said the tricks were resorted to when it was found the power could not be exercised at will. Those who have attended séances presided over by *uninterested "mediums,"* and have had the patience passively to wait for the manifestations, rarely were unsatisfied. I have no doubt some occult power exists, but I do not think it is dependent on the will of the person through whom it is manifested, and do not see the lesson intended to be taught. Once, many years ago, accident made me present at a séance. The whole character of the meeting precluded any idea of trick or collusion; *there was nothing to gain so far as I was concerned.* The evidence that something occurred out of the common course of man's intelligence was perfect (the manifest tations were in writing), and I have been unable to solve the mystery without resorting to supernaturalism. That solution I reject.

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[1] His conclusions were "that all substances were more or less luminous—emanations arising in the shape of lambent flames which were deflected by currents of air. In magnets and crystals they were most prominently present, metals followed, and they have been observed in some species of wood. Connecting his facts with the structure of the meteoric stones, he came to the conclusion that the earth is a magnet, and that the aurora displays were magnetic emanations." The results of his researches in this direction are, "Flaming lights exist over magnetic poles larger than the magnets from which they flow; . . . these flaming appearances are movable, undulating, often moving in serpentine windings, like those of a ribbon agitated by the wind, becoming every moment larger or smaller, shooting out rays, scintillating, variegated in colour, and often nebulous, vaporous, and cloud-like." "When we find that with our breath we can cause it to flicker backwards and forwards, and when we observe it increases in a rapid ratio in size, intensity, and brilliancy in rarefied air, and lastly, when we see it followed at every step by the play of rainbow colours, &c., there remains hardly an essential mark of distinction between the magnetic light and terrestrial polar light," "the difference being the magnetic light is seen only by the sensitive eye, whilst the polar light is discerned by ordinary vision" (Reichenbach, *Res. in Mag.*, p. 447, Gregory.)

All substances present odyllic or magnetic emanations, which are presented in colours diversified in accordance with the distinct character of the substances from which they come. If this be the fact of nature, the odyllic hypothesis of Reichenbach has an important bearing on the spectrum analysis, as ridding it of the incandescent phantom which appears to be considered of the greatest importance in spectrum observation, probably, after all, due to a particular train of thought long indulged in. When it is desired to subject a material to spectrum observation in order to obtain the extreme divisional tenuity it is probably necessary the particles should be excited by a state of incandescence. When a Sun, a Planet, or a Nebular mist is the object of examination, without the state of incandescence, from the immensity of the objects, the intensity of the magnetic emission, increasing in ratio to the bulk, would present the flames arising from the substances of which the masses were constituted in blended concentration and would mark the spectrum with the indicating colours, or with lines or gaps, showing the constituents of the pencil of light under observation. If all the orbs are self luminous, it does not follow that this luminosity is necessarily that of an incandescence. We can only reason by analogies on such objects as Suns and nebular mists, and have, therefore, to fall back on representative states as we find them on the Earth. On Earth we have heat, *scientifically* we call it temperature, in a *mild dynamic* state, in a still milder form it is met with in the *static* or *latent* state, as in refrigeration, or in its greater representative the cold of space, and also in extreme dynamical action through excitation, as combustion. In an electro-magnetic arch it reaches its greatest intensity, and yet the electrical condensation, divisionally distributed, gives the electric light with little or no (sensory) rise of temperature. If all stellar bodies be self luminous the luminosity, probably, is rather due to magnetic exhalations than to an incandescence. This view becomes more especially prominent when we consider that the spectrum examination proves that the passage of the electric current bears with it the substance of its conductor, *i.e.* the passage of the fluid through the conductor bears with it the magnetic emanations of the conducting substances, the metals, &c., being in a state of the extremest tenuity, it is only in contact, or in opposition, that the spark is elicited. Another reason against the incandescent hypothesis may be derived from comets, through which, in all parts of them, not excluding the nucleus, the stars of the eleventh and twelfth magnitude are seen. If comets be of incandescent substances this could not occur, the particles being in a state of incandescence would render the comet opaque: if, on the other hand, the light of the comet arises from the luminosity of the particles, they being in extreme division, wide intervals would exist between them, and thus any object on the further side would be visible through what Reichenbach calls the "lambent flames." Again, if the sun was composed of incandescent materials, it would not be possible for the spots to be objects of observation, nor would it be possible, owing to the intensity of the glare, that on their transit the planets could be seen on its face.[1]

Light painting the spectrum with the colour of the material composing it, shows that it is not a mere undulatory vibration of the ether, *but that it is itself, a material substance composed of particles in extremest tenuity, shining by their own emanations.* If this hypothesis be established, it can be said that *the colours in the spectrum show the materiality of light, and that the colours painted on the cloud, the rainbow, show the materiality of force.*[2] Science has distinctly shown that the colours of the rainbow are representatives of the forces acting in nature, we have as distinctions heat rays, light rays, and chemical rays. To go further, it may be said, that as the colours present in the spectrum are the symbols of substances, so on the cloud we have colours as the symbols of the forces, and as both the spectrum and the rainbow have representative colours, in the spectrum on the screen and on the cloud we probably see the representations of that primordial element from which both force and substance have emanated. The prisms in the spectrum apparatus are representative resemblances of the huger prisms formed through heat and its consequent moisture, containing within itself every necessary power of dispersion. *The painting on the retina then becomes the reflex of the primordial element in its primordial unit*, and thus we may say that the Universe in its objective presentment is a condensation of heat, out of which have grown all material phenomena, the diversities of substances having arisen from the intermixture of those correlated conditions we know as force.

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[1] The Herschells and Arago conceived the Sun to be inhabited or capable of habitation. It seems impossible they could entertain such an idea, had they really conceived a flaming substance enveloped the Sun, possibly they adopted this hypothesis because the then state of science gave no other explanation. Surround the earth with such an envelope, its elevation being in accordance with its lesser bulk, could life exist on earth?

[2] When the above was in the hands of the printer, W. Crookes read before the Royal Society (December 5, 1878), a paper upon certain observations he had made when experimenting on electrical discharges in vacuum tubes. The narrative was interesting and scientific, and practically illustrated minute analysis. The demonstrator's speculations on these experiments are important, and tend to the verification of the observations in the text. When a state of matter is announced as "*ultra gaseous*" the principle contended for in this treatise is lightened as to proof, viz. that when the atoms of a resin are known to be in a fluid, but which are undetected, when its spectrum is projected on the screen, under the highest magnifying powers known to art, that the substance has been resolved into its primordial *i. e,* into the ultra-gaseous. The observation made in relation to the *fourth* state of matter, that it is a world "where we can never enter," and "which we must be content to

In such a conception there is no denial of observed solar facts. The mechanics of the Sun would but be assimilated to those of the earth ; there would still exist igneous prominences as Volcanic eruptions—these stupendous emissions present precisely those appearances we might expect from the eruptions on the earth viewed from a distant aërial point—the sun eructations being magnified in the proportion of the respective bulks of the Sun and the Earth. The lower red eruptions, be they flames or lava floods, seen on the circumferenee of the sun, would be representative of volcanic eruptions or of lava streams. The proposition con-

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observe . . . from the outside," applies to all investigations of ultimate phenomena, if not, to all phenomena. Lockyer also by his observations of spectrum phenomena throws a doubt on the scientific formula relating to elemental substances ; his experiments on copper, so far as that metal is concerned, appear to be conclusive. If one element be resolved it is not improbable that in time all the others will be. These discoveries, when connected, show there is a beyond even to assumed scientific ultimates, and that a region is approached where the imponderables are specific realities. Mr. Crookes appears to have elicited by his experiments the corpuscular theory ot light (*Newton's Emission Theory, vide sup.*, p. 279), so long rejected by science. This announcement adds to the observation in the text, viz. that light is a substance in the extremest state of tenuity: the proposition was based on the presentments of the spectrum analysis ; but when it is shown that light in certain conditions moves in curves, which curves are capable of variation, little is wanted to prove that light is innate in substance. This proposition I advanced, relying on the principle that a mass composed of particles (the condition of all bodies) possesses but the powers and properties inherent in the aggregated particles. Were this otherwise, light and force would be motions or substances foreign to material bodies. The orbs, suns and worlds, &c., are pronounced to shine by their own light; these orbs are formed of particles, hence it would seem to follow that the particles composing them are self-luminous and contain within themselves the light by which they become apparent to sight (*vide* note 1, p. 207 ; note 1, p. 215).

tended for gains consistency from the fact that the sun's appearance observed in the eclipse in India, 1868, appeared to be wholly changed in the eclipse of 1878, observed in America. The brilliancy of the corona is probably an auroral display, magnetic emanations from the great orb of the sun. The Earth seen from the moon would probably present a similar grandeur. The sudden appearance and disappearance of these prominences, their bending back on the body of the sun, is exactly what might be expected from volcanic eruptions—the floating cloudlets, left after the disappearance of the prominences, are most probably the smoke and débris of the volcanic evictions.

It does not seem to be true philosophical conception to assume for the mechanics of the Sun a different solution from that given to the mechanical constructions observed of the Earth, unless overwhelming evidences are adduced in support of such an hypothesis. If the substances of Suns and the other orbs floating in the firmament be, as Newton suggested, composed of the same materials, this the spectrum analysis appears to confirm, asserting for them an almost analogous constitution, fair reasoning would lead to the acceptance of the premiss, that all the orbs composing the astral system or universe are the results of the same substances and the same working forces, differentiated in accordance with the squares of their proportions. In such a conception homogeneity and order would be the fact of the Universe, as projected from and superintended by an Infinite Intelligence; as in the Universal alone is found the true, to the Universal then we must look for the solution of all Kosmic conceptions.[1]

In saying farewell to my readers, I would remark that the most gifted minds in the attempt to unweave the web which encircles "the waifs" that float on the ocean of time, have found that all their efforts have only placed them in the vestibule of the infinite, the beyond being unapproachable, "the unknown," from whence a pencil of light occasionally streams, reveals the abysses wherein intellect is enthroned, in the majesty of its being. Man's perceptions are but forms magnetically impressed on the retina—were these sense perceptions our all, the mind of man would be but a more comprehensively progressed instinct. Within man is a beyond, and when the mind becomes abstracted from sensuous perceptions, in the intangible it perceives the Real, the Universal, the Enduring, the Unfading, the Eternal. In every object of perception, in every ideal conceived, the Known and the Unknown are so intimately intermixed that to the finite there can be no finality, therefore man cannot comprehend all the Finite. If the things of the finite baffle research, the Unfathomable infinite must necessarily be the more inscrutable. If the boast of Nägeli were consummated, man then would be at the apex of his power, and yet still would be environed by the inaccessible and unapproachable; and but for the *alter ego* enshrined in the inmost recesses of his intelligence, he could conceive no beyond—no Infinite concealed in the Finite.

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[1] "To go on the forlorn hope of truth is a service of peril. Who will undertake it if it be not a service of honor? It is easy enough after the ramparts are carried to find men to plant the flag on the highest tower. The difficulty is to find men who are ready to go first into the breach" (*Macaulay's Essays*, vol. ii, p. 218). All experimental sciences are in a state of progression. "There was a time when the most powerful of human intellects were deluded by the gibberish of the astrologer and the alchemist;" "but as time advances, facts accumulate, doubts arise." "First come hints, then fragments of systems, then defective systems, then complete and harmonious systems. The sound opinion held for a time by one bold speculator, becomes the opinion of a small minority, of a strong minority, of a majority of mankind. Thus the great progress goes on, until the schoolboys laugh at the jargon which imposed on Bacon." "From the great advances which have been made . . . in every species of knowledge, we infer, not that there is no more room for improvement, but that in every science . . . immense improvements may be confidently expected" (ib. 215).

If there be Law in Nature, there must have been an antecedent to law. If there be Form in Nature, there must have been Intelligence to arrange it—hence an antecedent to form. If there be Order in Nature, there must have been Direction, direction is the antithesis of *accident* or chance. If the Earth spontaneously (*æquivoca generatio*) produced, it was fecund through Vital Energy. Lucretius said of the earth, "she being *impregnated* produces" (*supra*, p. 173). If in Nature there was Generation, it had an antecedent. From law results homogeneity and order, showing a purpose in its institution; if Purpose, then intelligent direction. As in Nature are found LAW, FORM, ORDER, VITAL ENERGY, GENERATION, DIRECTION, PURPOSE and INTELLIGENCE, then Intelligence *was perfected* in their UNITY. If there be Unity, there must be Individualism, if an individualism, then a Personification; and we arrive at *an individualized* or *personified intelligence*, hence at *Essence or Spirit*. This Essence or Spirit would comprise in itself all *Wisdom and Power*, for in it and through it, the Lessons of Nature teach, are all PHENOMENA, hence it is Omniscient, Omnipotent, Omnipresent, hence an ENTITY. Principles are Universal, and their Universality constitutes the GREAT POSITIVE MIND, *Almighty and Eternal;* at whose *fiat* the Kosmos arose. This Personified Intelligence *rules All*, *perfects All*, *exists in All*—hence this Great Positive Mind, Omniscient in wisdom, Omnipotent in power, Omnipresent in Spirit, is the GREAT PERSONAL ENTITY which *created*, *directs and superintends*,—it is the Great Vital Energy. Must we not say, that this Great Intelligence, Eternal in its ENTITY, *is* GOD, *the Creator of the Kosmos, its Intelligent Director, and its Providence.*

To have adequately presented the subjects commented on in this treatise would have required volumes; therefore the effort has been confined to an exposition of their broader features. Generally the facts of Science have been accepted, the review exposes speculative hypotheses *ultra* as any pictured by theologies or idealistic superstitions. For force and matter Physicists assume certainty and finality; when on examination both are found to be evanescent and changing, there is no principle revealed whereon the REAL can be based. On the assumption that certainty constitutes the basis of scientific hypotheses, as from a stronghold, Theologies are assailed. It were quite as scientific to say that a negro is not a man because his skin is black and his hair woolly, as to say that Theologies are unreal because *à priori* conceptions are adduced as their fundamental bases, and that necessarily they are uncertain because these bases cannot be objectively presented; to this length the adverse argument extends. Science and Theology have their origin in the Finite; Science being formulated through symbolic perception—Theology through a conceptive idealism. Faith is a necessary element in both systems, they being but the embodiment of man's thought; on the one side faith is concentrated in material projections, on the other in an ideal sympathy. As neither system can adduce in verification that proof which an imperative certainty demands, it seems a visionary presumption for either to assume that they have solved the mystery of the problem involved in the being of man. It may be said that Intelligence, as the conceptive and subjective, exceeds the perceptive objective, so Theology, because of the subjectivity of the basis it assumes, transcends the material hypotheses. If the contention be *matter* or *spirit* as the Ultimate from whence all has arisen and to which all will return—there is little doubt but that both deductive and inductive evidences point to the latter, because whatever the argument adduced, the subjective principle must precede the objective presentment. The one fact appertaining to the races of man, universal in its application, is the *Religious sentiment*, and whether its expression be a faith, a creed, or a superstition, it presents the broad line of demarkation between animal instinctives and human intelligence—indissolubly blending the perceptive and material with the conceptive and ideal. If there be any persistent universal principle inherent in the arguments adduced, it is that intelligence (broadly defined as the spiritual) precedes all material presentments.

It has been my endeavour fairly to present the possibilities of the Material and Spiritual positions. All cultured men have capacity for the examination of the premisses, but all men have not the leisure, and this must plead my excuse for intruding into those realms of Chaos—Science and Theology. Certainty has been my quest and the result of my research, shortly put, *is that the measure of truth is its universality, and that in this universality alone, certainty is to be found: a hard and fast line which admits of no deviation;* all beyond being an interminable confusion. *Man does not and cannot know all the finite.* The processes of Science show the conflict of hypotheses wherein the tangible and intangible, the supposititious and the real, the material and spiritual, are confusedly mingled: the researches of Philosophy disclose man's intelligence to be everywhere overshadowed by the Infinite and the Unknown, at the same time evolving spiritual possibilities which appear to be lost in the mystic and the marvellous. In the quest for *the Ultimate*, the possibilities of the Finite find their expression in Du Bois Reymond's aphorism—

IGNORAMUS IGNORABIMUS.

J·W

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